Nunung Nuryartono

# Impact of Smallholders' Access to Land and Credit Markets on Technology Adoption and Land Use Decisions: The Case of Tropical Forest Margins in Central Sulawesi-Indonesia

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# Impact of Smallholders' Access to Land and Credit Markets on Technology Adoption and Land Use Decisions: The Case of Tropical Forest Margins in Central Sulawesi-Indonesia

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# Abstract

This study examines the impact of smallholders' access to land and credit markets and its impact on the adoption of technologies as well as land use decisions in the vicinity of the Lore-Lindu national park, Central Sulawesi, Indonesia. The study focuses on upland areas which are devoted to cocoa and coffee because these agricultural activities contribute to the pressure on the Lore Lindu National Park. At the current level of forest encroachment, these activities threaten the existence of the Lore Lindu National Park. The adoption of technologies as an indicator of agricultural intensification can play an important role in reducing the pressure on the forest. A necessary condition to apply advanced technology is the availability of sufficient financial capital. However, most of the farm households in the vicinity of the Lore Lindu National Park are categorized as smallholders and face a lack of capital. Therefore the role of rural financial services to relax their liquidity constraint is important. In the analyses the rural financial services are divided into informal and formal credit institutions. The various econometrics model used in the analysis are: (1) the determinants of land possessions by households, by using a tobit model; (2) the determinants of households access to and participation in informal credit markets by using a probit model; (3) the determinants of technology adoption by using a two step and recursive model; (4) The determinants of the households' credit constraint by applying a probit model; and (5) the impact of households credit constraint on land use decisions by using a switching regression model.

The common mode of land acquisition in the upland area was by clearing primary forest, even respecting the current generations. In contrast, in the lowland area the common

mode was through inheritance. Only 20 percent of the plots have an accompanying land certificate because of the complexity of the land registration process and the lack of awareness among the households of the need to register land.

The causal analyses of land acquisition showed that there is a close relationship between poverty and forest land acquisition. Land acquisition is influenced by various factors, including the ownership of forest land and household ethnicity where local/indigenous people tend to bequeath their land to their extended family.

In the case of rural financial services, there are two types of credit institutions: formal and informal. These credit institutions differ in their characteristics, clients, and the financial services provided. The econometric analyses shows that some variables represent significant risk bearing indicators which suggests that the informal lender is an important agent for providing money to the poorest households.

Important factors in determining access to formal credit institutions are human capital (represented by the age and the education of the head of the household) and household assets (human capital is also a household asset).
The amount of money borrowed (the demand side) is determined by the welfare status of the households, land title ownership, area of land cultivated, and the credit institution where the household became a client.

The adoption of technology is positively influenced by the predicted amount of money borrowed, social capital, and the age of the head of the household. The farther the house of a household is from the road, the less technology is applied

The results of the analysis of the determinants of the households which are credit constrained show that human capital has a positive impact in reducing the probability that a household is credit constrained. Household income has a positive effect in reducing the credit constraint. Risk-bearing indicators confirm that a larger family size will increase the probability that the household is credit constrained

The study further highlights the fact that households which are not credit constrained tend to expand their agricultural activities into the upland areas to cultivate cocoa and coffee.

# Zusammenfassung

Diese Studie untersucht den Einfluss des Zugangs zu Land- und Kreditmärkte auf die Einführung von Technologien und auf Landnutzungsentscheidungen von Kleinbauern in der Umgebung des Lore-Lindu-Nationalparks, Zentralsulawesi, Indonesien. Im Mittelpunkt der Untersuchung steht das Hochland, in dem insbesondere Kaffee und Kakao angebaut werden, da die Ausweitung dieser landwirtschaftlichen Aktivitäten den Nationalpark gefährden. Die Einführung neuer Technologien kann eine wichtige Rolle spielen um den Druck auf die Waldgebiete zu reduzieren. Die Verfügbarkeit ausreichender finanzieller Mittel ist eine wichtige Vorraussetzung um fortgeschrittene Technologien anwenden zu können. Jedoch handelt es sich bei den meisten Bauern in der Umgebung des Lore Lindu National Parks um Kleinbauern mit Mangel an Kapital. Ländliche Finanzdienstleistungen sind deswegen notwendig um deren Liquidität zu verbessern. Bei der Analyse ländlicher Finanzdienstleistungen werden formelle und informelle Kreditinstitutionen unterschieden. Folgende ökonometrische Modelle wurden zur Analyse verwendet: (1) Tobit Model zur Untersuchung der Einflussfaktoren auf den Landbesitz von Haushalten, (2) Probit Model zur Untersuchung der Einflussfaktoren auf den Zugang zu informellen Kreditmärkten, (3) Zweistufige sowie rekursive Modelle zur Untersuchung der Einflussfaktoren auf die Einführung von Technologien, (4) Probit Model zur Untersuchung der Einflussfaktoren auf Kreditbeschränkung und (5) „Switching“-Regressionsmodell für den Einfluss von Kreditbeschränkung auf Landnutzungsentscheidungen.

Die allgemeine Form der Landaneignung im Hochland ist bis heute das Abholzen von Primärwald. Im Gegensatz dazu ist im Tiefland die gängige Form des Erwerbs von Land

die Vererbung. Nur für 20 % der Grundstücke besitzen die befragten Haushalte ein Landzertifikat, welches den Besitz offiziell bestätigt. Hauptgründe für diese geringe Zahl an Zertifikaten sind die Komplexität des Registrierungsprozesses sowie das mangelnde Bewusstsein der Haushalte über die Wichtigkeit der Registrierung.

Die Analyse der Einflussfaktoren auf die Landbeschaffung zeigt einen starken Zusammenhang zwischen Armut, ethnischer Zugehörigkeit und Waldflächenakquisition.

Formelle und informelle Kreditinstitutionen unterscheiden sich in ihrer Charakteristik, ihrer Kundschaft sowie den angebotenen Finanzdienstleistungen. Die ökonometrische Analyse zeigt, dass der informelle Kreditgeber ein wichtiger Bestandteil in der Beschaffung von Geld für die ärmsten Haushalten darstellt.

Wichtige Faktoren, die den Zugang zu formellen Kreditinstitutionen bestimmen, sind das Humankapital (dargestellt durch Alter und Ausbildung des Haushaltsvorstandes) und das physische Kapital des Haushalts. Die Höhe des geliehenen Geldes ist abhängig vom Wohlstand des Haushalts, dem Besitz von Land, der Anbaufläche sowie den Kreditinstitutionen, bei denen der Haushalt Kunde ist.

Die Einführung von Technologien wird positiv durch die Höhe des geliehenen Geldes, dem Zugang zu Sozialkapital und dem Alter des Haushaltvorstandes beeinflusst. Je weiter ein Haushaltes von einer Strasse entfernt wohnt, desto weniger werden Technologien angewandt.

Haushalte, die keinen Zugang zu Krediten haben oder Kredite nicht in der gewünschten Höhe aufnehmen konnten, gelten als kreditbeschränkt. Die Analyse der Einflussfaktoren, zeigte den negativen Einfluss von Humankapital und Haushaltseinkommen. Im Gegensatz dazu haben größere Familien eine höhere Wahrscheinlichkeit kreditbeschränkt zu sein. Die Studie zeigt weiterhin, dass Haushalte ohne Kreditbeschränkungen tendenziell ihre landwirtschaftlichen Aktivitäten im Hochland ausweiten um Kaffee und Kakao zu kultivieren.

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This work is dedicated to my late father, H.Poernomo who taught and gave me the important meaning of life.

Göttingen, July 2005 *Nunung Nuryartono*

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| | |
|---|---|
| Anova | Analysis of Variance |
| BLUE | Best Linear Unbiased Estimator |
| BRI | Bank Rakyat Indonesia |
| BRI-UD | Bank Rakyat Indonesia-Unit Desa |
| BPN | Badan Pertanahan Nasional |
| BPR | Bank Perkreditan Rakyat |
| BPTP | Badan Pengkajian Teknologi Pertanian |
| BPS | Badan Pusat Statistik |
| CLR | Classical Linear Regression |
| FOB | Free on Board |
| GDP | Gross Domestic Product |
| GDPR | Gross Domestic Product Regional |
| Ha | Hectare |
| Kg | Kilogram |
| Kupedes | Kredit Umum Pedesaan |
| KUT | Kredit Usaha Tani |
| IMR | Inverse Mills Ratio |
| MFI | Microfinance Institutions |
| MLE | Maximum Likelihood Estimators |
| OLS | Ordinary Least Squared |
| SC | Selection Criteria |
| SRM | Switching Regression Model |
| STORMA | Stability of Rain Forest Margin |
| Rp | Rupiah |
| TNLL | Taman Nasional Lore Lindu |
| VIF | Variance Inflation Factors |

# 1 Introduction

## 1.1 Background

Most developing countries continue to rely on their agricultural sectors for economic growth, poverty alleviation, food security, and environmental sustainability. In Indonesia, agriculture contributed 15.6 percent to the Gross Domestic Product (GDP) in 2001 (BPS, 2005). Although its contribution to economic development has a tendency to decline, agriculture remains important to the majority of the Indonesian population, particularly to those who live in rural areas. More than 50 percent of the households in Indonesia depend on agriculture activities as their main source of income. However, more than half (56.5 percent) of these farm households are categorized as smallholders with landholdings of less than 0.5 ha.

A lot of importance has been placed on the role of agricultural innovations in improving the welfare situation of the smallholders. Technology adoption significantly influences agricultural productivity and, in turn, household income. In addition to its importance in income generation, the adoption of new technology is important as an alternative to extensive agricultural practices. The extensive agricultural practices through forest encroachment still occur in some regions such as in Central Sulawesi Province and this contributes to environmental degradation.

However, to undertake productive investments in agricultural technology, smallholders require sufficient access to financial capital.

## 1.2 Problem Statement

In Central Sulawesi, there is a tendency to engage in forest encroachment, either by smallholders and other farmers who live in forest margin areas or by external investors who seek to exploit the forest margin for timber and tree crop plantations. The socio-economic households' survey by STORMA 2000/2001 found that 24 percent of the households in three districts cleared primary forest as one of several ways to gain access to arable land (van Rheenen et.al, 2004). Indigenous people living near protected forests gain access to land by clearing the forest, believing that the forest is ancestral land which belongs to them and, therefore, can be utilized by the community.

The problem arises because of the overlapping status of the forest. Forest can be regarded as state property; at the same time, however, the community considers forest to be communal property or, even more, as an open access resource. Therefore, the ownership of land cleared from forest is in general insecure.

Ownership insecurity can affect loss of future income due to conflicting challenges (Deininger and Feder 1998). Therefore, ownership security clearly increases the subjective payoff from productivity-enhancing long-term investments that are fixed to the land such as tree crops, terracing, and irrigation infrastructure. Apart from investment incentives, another important issue related to the security of land ownership is the access to formal credit as banks usually require land to be pledged as collateral.

To reduce the pressure of environmental degradation due to encroachment, there must be an alternative strategy for farming that does not replace forestland with cultivated areas. The adoption of a new technology such as intensifying agricultural practices can reduce the pressure of environmental degradation and simultaneously increase productivity.

Credit markets in rural areas play a crucial role in financing intensive agricultural activities. The supply of credit, especially from formal institutions, frequently depends on

the provision of collateral. For this purpose, land possesses several attributes which make it a desirable form of collateral (Feder and Onchan 1987). However, whether or not land can be used as collateral depends on the ability of borrowers to pledge titled land.

Besides providing collateral, the problems still arise, as many studies have shown, because of not all the rural societies have the opportunity to obtain financing, either from formal or informal credit institutions. In fact, one of the main reasons why farmers do not intensively apply advanced technology is the lack of capital. Smallholders may be perpetually trapped in poverty due to the lack of finances needed to undertake productive investments (Von Pischke, Adams, and Donald, 1983).

## 1.3 Objectives of the Study

This study is intended to contribute to an improved understanding of the interlinkages between access to land and credit and the investment and production behaviour of the farmers. By studying the situation in the vicinity of the Lore Lindu National Park, the overall objective is to study the impact of the household's access to land and the credit markets on the adoption of agricultural technology and land use decisions.

The main research questions are:

1. How do households acquire land for agricultural activities?
2. What factors contribute to the process of land possession among villagers?
3. How do rural financial markets perform?
4. What factors influence the households' access to and participation in informal credit markets?
5. What factors contribute to households being credit constrained in formal credit markets?
6. How does access to land and to formal credit influence agricultural technology adoption, and how does the adoption of technology affect the productivity in smallholder agriculture?
7. How does credit rationing influence the households' decision to allocate land to cocoa and coffee in the uplands?

The main research tasks are:

1. To describe and classify the types of acquisition and exchange of farmland

Above all, this research will explore in detail different systems of acquisition and the exchange of farmland and forest and their impact on the equity of land distribution among different socio-economic groups (local people, migrants, urban dwellers investing in cash-crop farming).

2. To describe and analyse the performance of rural financial services and the behaviour of borrowers.
3. To analyse the determinants of the households' access to land, particularly the accumulation of land over time.
4. To analyse the determinants of the households' access to and participation in informal and formal credit markets.
5. To analyse the determinants of the households' credit-constraints in formal credit markets
6. To analyse the effect of the households' access to land and formal credit on the adoption of technology, including aspects of land use that particularly affect the protected forest frontier of the Lore Lindu National Park.

## 1.4 Organisation of the Study

This study is organized in eight chapters. Chapter 1 provides an introduction and background to the important issues investigated, followed by the objectives and research questions.

After the introduction in Chapter 1, Chapters 2 presents the basic theoretical framework and concepts of property rights in the land market, characteristics of the rural credit market, credit rationing, and imperfect information. This chapter also presents recent studies focusing on the impact of access to financial markets on different production and welfare outcomes. Based on these concepts and empirical evidence, the chapter proposes a conceptual framework for guiding the empirical analysis in this dissertation.

Chapter 3 focuses on the detailed methodology used for the analysis. The chapter presents a sampling frame for the selection of survey households and the process of data entry and cleaning to obtain reliable data for the analysis. This is followed by a presentation of the different tools of descriptive data analysis which is followed by a

discussion of methodological issues concerning the econometric models. The chapter gives an explanation of the mechanisms used to determine whether a household is credit constrained. The chapter ends with the focus on the different econometric models as tools for undertaking causal analysis such as Tobit, Probit, selection bias, and the switching regression model.

An overview of the Central Sulawesi Province and the study area is the main focus of Chapter 4. Socio-economic dimensions and land use characteristics are briefly reviewed in the chapter. This is followed by an exploration of the present development process, particularly in the agricultural sector, and its contributions to economic growth.

Chapter 5 presents detailed analyses of the modes of the households' acquisition of land. Land tenure systems as well as land use are discussed. A better understanding of land distribution is gained by the analysis of the Lorenz curve to graphically show the land distributions and calculate the Gini Index. This section specifically seeks to explore the determinants of the different pathways through which households acquire their land holdings by estimation using a Tobit model.

Chapter 6 provides general information about rural financial markets in the research area which are characterized as dual markets: formal and informal credit markets. In the case formal credit markets, the focus is on the performance of three local branches of the village banking (Unit Desa) system of BRI, the major rural public bank in Indonesia. The descriptive analyses following this section explore in detail the different activities related to the outreach, i.e, the distribution of loans by different indicators of formal and informal credit markets. The analyses of the households' access to and participation in both markets are given and differentiated by socio-economic characteristics. This chapter concludes with a discussion of the results from the econometric analyses of the determinants of households' access to and participation in informal credit markets.

Chapter 7 concentrates on the analyses of the impact of the households' access to credit on the adoption of agricultural technologies by using a recursive model. Descriptive analyses of different types of technology applied and factors influencing the adoption of technology are provided in order to present an overview of the agricultural practices, particularly respecting irrigated land where rice is the main crop. This is followed by the

analyses of the determinants of the households' access to formal credit and the amount of money borrowed as a part of the recursive model. One of the central objectives of this study is to combine a theoretical analysis of credit rationing with the empirical analyses. In section 7.6, the analyses of the determinants of credit constraint and its impact on land use decisions are presented, particularly on the area of upland devoted to cocoa and coffee as a proxy for the pressure on the protected area of the Lore Lindu National Park. For this analysis of the impact of credit constraints on forest encroachment and tree crop investment, a switching regression model is used.

Chapter 8 summarizes the findings of the study and presents their policy implications.

# 2 LITERATURE REVIEW AND THEORITICAL FRAMEWORK

This chapter develops several theoretical frameworks based on different theoretical concepts that offer different building blocks which are useful for analysing the relationship between land and credit markets. The first topic concerns the relationship between property rights and access to land. The second topic is related to the different taxonomies of credit constraints and access to credit and their impacts on different things such as the adoption of technology and land use decisions.

## 2.1 Property Rights in Land Markets

In agrarian societies, land is an essential factor for production along with labour, capital, and other agricultural inputs. However, land cannot be treated the same way as other inputs of production due to its peculiarities. The embedded characteristic of land is that the quantity or supply of land is fixed. Land cannot be produced, and the amount of land available can also not be increased, decreased, or destroyed. The implication of these characteristics of land is that supply is perfectly inelastic (vertical) and completely unresponsive to the demand.

This situation leads individuals to hold a certain amount of land. As (Deininger and Binswanger 2001) assert, there are some advantages of access to land through individual ownership:

1. Land is an effective tool to accumulate wealth and to transfer wealth to the next generation.
2. Land ownership serves as collateral for access to credit.
3. Land ownership is a source of self-insurance and old-age social security: land can be sold, rented out, or pawned for smoothing consumption in response to shock and life cycle stages.
4. Land ownership is a source of security in the case of continued access to the same plot of land, offering the possibility of capitalizing on long-term investments and a source of local social capital.
5. Land ownership is a source of social status and bargaining power.

However, as some cases show, individual land ownership is often completely without tenure security, due to the process of land acquisition. Place, Roth, and Hazell (1994:19) define land tenure security as existing when an individual perceives that he or she has the right to a piece of land on a continuous basis, free from interference from outside sources. Bromley (1992) defines property rights as the rights to have access to or control over a resource from which some form of benefit stream is expected. (Pejovich 1990) emphasized further that the right of ownership consists of four elements : (1) the right to use an asset (usus); (2) the right to capture benefits from assets (usus fructus); (3) the right to change its form and substance (abusus); and (4) the right to transfer all or some of the rights specified under points (1), (2), and (3).

In principal, there are four basic ideal analytical types of land property rights according to (Feder and Feeny 1993): a) none (open access), b) communal property, c) private property, and d) state property. These rights include right to use and to exclude use, right to the outputs from the land and the right to transfer the land or its outputs to other users. Under open access, rights are left unassigned and, therefore, imply a lack of incentives to conserve and may lead to degradation of resources. Under communal property, exclusive rights are assigned to a group of individuals. Under state property, the management of the

land is under the authority of the public sector. With private property, an individual is assigned the rights.

The institution of property rights, particularly in the case of private property, can be divided into two types: informal (customary tenure based on orally assigned rights) and formal institution (based on land records and land titles). In Central Sulawesi, particularly in the rural areas, the institutions of property rights are commonly an informal institution. One of the reasons behind this is that the landholdings belonging to the households were acquired by encroachments upon the forest or more frequently, were incidences of land transfers through inheritance of what was formerly also encroached land. Insecurity of land property rights associated with the lack of well-defined property rights can be understood as a random probability of loss of future income due to conflicting challenges (Deininger and Feder 1998). Eliminating such a threat through formal institutions (land titles) clearly increases the subjective payoff from productivity-enhancing long-term investments by prohibiting land loss in the future.

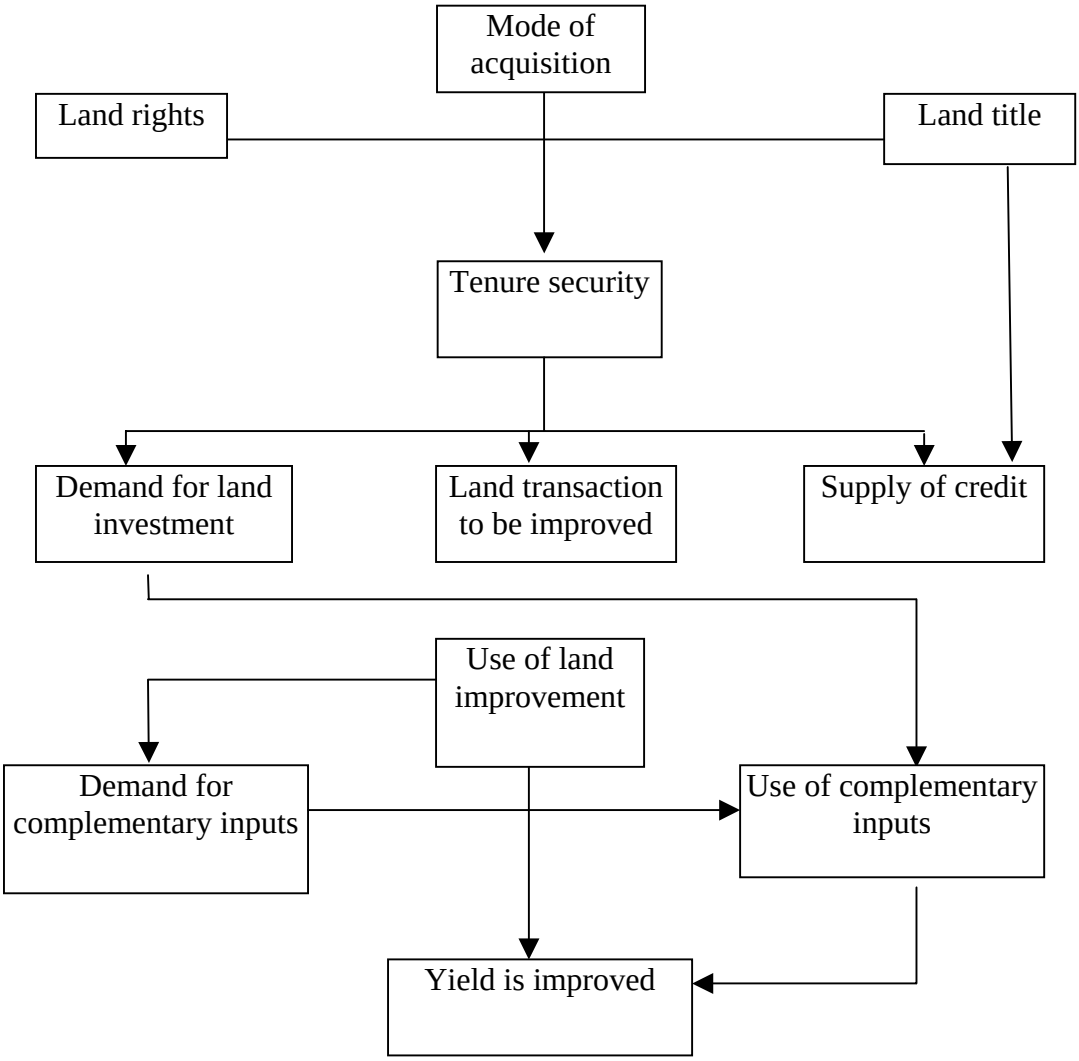
Furthermore, if land ownership is followed by secure property rights, this could lead to at least three embedded effects according to (Braselle, et al. 2002). First is the assurance effect which means that farmers have greater incentive to undertake investments if they feel more secure about their right to maintain long-term use of their right. Second is the reliability effect which shows that when land can be more easily converted into liquid assets through sale, it is easier to make improvements through investments. Last is the collateralisation effect which means that farmers are in a better position to invest because land acquires collateral values and access to credit is easier when freehold titles are established.

Place, Roth, and Hazell (1994) describe the consequences of land tenure security on different factors as depicted in Figure 2.1.

Increasing tenure security affects the demand and supply sides simultaneously. The demand side represents incentives influencing the farmers through two channels: (1) with higher tenure security, farmers are more likely to capture the investment return; and (2) increased tenure security is expected to reduce potential conflicts. Therefore, there is an incentive for farmers to demand more inputs for enhancing their agricultural activities.

The supply side represents incentives to lenders. Increased tenure security enhances the value of land that can be pledged as collateral. This will improve creditworthiness as a result of an increase in the lenders' expected returns, particularly in the case of long-term loans.

Figure 2. 1 Relationship between Land Ownership Security, Access to Credit, and Farm Productivity




Source : Adapted from Place, Roth, and Hazell (1994 : 17)

## 2.2 Rural Credit Market

In fact, the major economic activities in rural areas still rely on agricultural activities. In Indonesia, almost 50 percent of the population lives in rural areas and agricultural production is still the main source of income generation. Nevertheless, they still face

some problems related to the limitation of resources such as a lack of capital to improve their production. Therefore, rural credit markets are still needed as stimulants for agricultural production.

Agricultural activities are characterized by a time lag between planting and harvesting, and farmers are typically faced with very little cash revenue during this period. At the same time, expenditures for materials, purchased inputs, and consumption must be made in cash. The availability of credit allows both greater consumption and volumes of purchased inputs used and, therefore, increases the welfare of the farmers. Zeller (1997) asserts that access to credit has a significant effect on improving the welfare of households through three pathways: (1) through the alleviation of the capital constraint on agricultural households (access to credit can, therefore, significantly increase the ability of poor households with little or no savings to acquire agricultural inputs); (2) by increasing a household's risk-bearing ability and by altering its risk coping-strategy; and (3) by enabling access to credit for consumption smoothing.

Although there are positive effects of access to credit, in reality not all households have the same opportunities to be involved in the credit market. The equilibrium mechanism in the credit markets is not the same as in other markets. As a general rule, every market price adjusts automatically to meet demand and supply. If there is excess demand (demand is higher than supply), the price will rise, which is followed by an increasing quantity of supply. Adam Smith called this mechanism the 'invisible hand' by which price will clear markets. As a result, equilibrium will be attained where demand equals supply.

In rural areas, there are typically two types of credit institutions: formal credit and informal credit institutions. Formal credit markets, provide mediation between depositors and lenders and charge relatively low rates of interest that are usually government subsidized (Hoff and Stiglitz, 1993). Money in informal credit markets is lent by private individuals, professional moneylenders, traders, landlords, friends, and relatives.

The characteristics of informal credit markets are: (1)loans are often advanced on the basis of oral agreements, thereby lowering transaction costs; (2) the credit market is usually highly segmented; 3)interest rates are much higher on the average than in the case

of formal credit markets; 4) the markets interlink with other markets, such as the land, labour, or crop markets; 5) there is a tendency toward monopolistic behaviour by the moneylenders; and 6) there is significant credit rationing. (Hoff and Stiglitz 1990); (Zeller 1994); (Ghosh, et al. 2001); Atieno, 2001).

Looking at the coverage activities, the amount of money borrowed, and the segmentation of borrowers between formal and informal credit, the two institutions are different. The evidence in Madagascar (Zeller 1994) indicates that there is little competition or spill-over competition between informal and formal institutions. From a study in Malawi, Diagne (1999) concludes that formal and informal loans are imperfect substitutes. In particular formal credit, whenever available, reduces but does not completely eliminate informal borrowing. This suggests that the two forms of credit fulfill different functions in the households with the respect to inter-temporal transfer of resources.

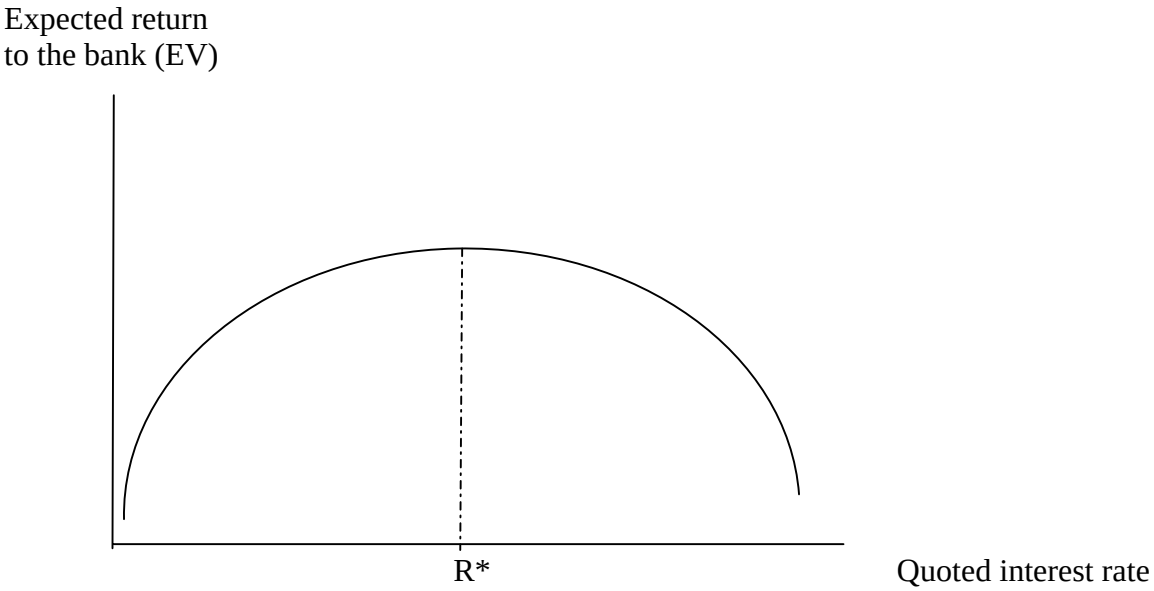
In formal credit markets, one of the conditions that must be fulfilled is that the borrower has to put down collateral for the contract. According to Binswanger, Mc Intire, and Udry (1989) collateral basically has four effects. At a given interest rate: (1) it increases the expected return (and reduces the variance of return) for the lender; (2) it partly shifts the risks of loss of the principle from the lender to the borrowers; (3) it provides additional incentives for the borrowers to repay the loan; and (4) it has a screening effect on the applicant pool, discriminating against poor but often credit-worthy loan applicants with little or no suitable collateral.

Secure land ownership with a land title is one of the ideal collaterals that is demanded by a lender. The reason is that because of its immobility and virtual indestructibility, it has easily transferable ownership rights. According to Deininger and Feder (1998), the provision of collateral facilitated by the possession of a formal land title is generally a necessary condition for participation in formal credit markets for medium and long-term credit. Moreover, Meyer (1990) asserts that access to loans and loan sizes are usually correlated with land ownership, particularly in underdeveloped formal financial systems. Therefore, inequalities in land ownership are often the cause and the effect of credit market inequalities.

## 2.3 Equilibrium in Credit Markets

The expected return earned on a loan is a function of the quoted interest rate. Figure 2.2 shows the relationship between the expected return on a loan and the quoted interest rate. This figure shows that increasing the interest rate charged does not proportionally increase the return to the bank because the probability of default may rise. The bank will not charge an interest rate above $R^*$, and as a result at this point the expected return will be maximized.

Figure 2.2 Expected Return for the Bank as a Function of the Quoted Interest Rate

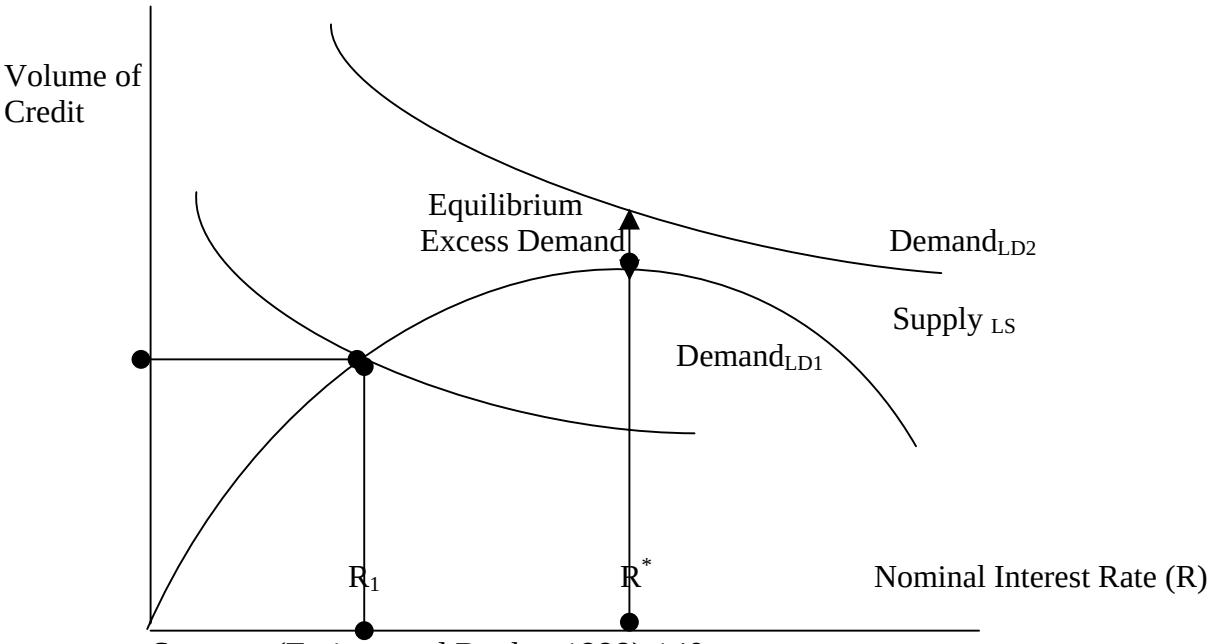



Source : Jaffee and Stiglitz, 1990 : 854

Credit rationing exists if there is an excess demand for credit. Following the general rule for market clearing, if the demand for credit exceeds its supply, this will be followed by an increasing price for loans in terms of interest rates. The supply of loans will increase and demand will decrease until a new equilibrium is achieved. However, at the point of $R^*$ there is no incentive for the bank to increase the interest rate because its return will decrease if it does so. As a result, as long as the interest rate is above $R^*$, market equilibrium is characterized by credit rationing and each lender maintains the interest rate below $R^*$, even though there is excess demand.

Figure 2.3 shows details of the interaction between supply and demand in the credit market which leads to credit rationing

Figure 2.3 Equilibrium Credit Rationing




Source : (Freixas and Rochet 1998):140

Interaction between supply and demand leads to an equilibrium condition if the demand schedule is LD1 and supply is LS. The nominal interest rate $R_1$ clears the market. In contrast, when the demand schedule increases up to LD2, this leads to a condition in which the demand and supply curves do not intersect. In this condition, an equilibrium of the credit market occurs with credit rationing which is characterized by the nominal interest rate $R^*$ and zero profit for the bank.

## 2.4 Concepts of Credit Rationing

(Jaffee and Modigliani 1969) proposed a definition of credit rationing which states that it occurs in a situation in which the demand for commercial loans exceeds the supply of these loans at the commercial loan rate quoted by the banks. They distinguished two forms of credit rationing depending on the status of commercial loan interest rates; equilibrium and dynamic rationing.

(Russel and Jaffee 1976):651) mentioned that credit rationing occurs when lenders quote an interest rate on loans and then proceed to supply a smaller sized loan than that demanded by the borrowers. They divided borrowers into two groups: honest borrowers who accept only loan contracts that they expect to repay, and who do, in fact, repay them; and dishonest borrowers, who default on loans whenever the costs of default are sufficiently low. The lender cannot distinguished between the two types of borrowers.

(Bester 1985) notes that credit rationing appears when the lenders are imperfectly informed about the default risks of the borrower, so that the equilibrium level of borrowing is reduced. (Baltensperger and Devinney 1985) viewed the situation of credit rationing simply as " a fringe of unsatisfied borrowers."

(Besley 1994) emphasized that market failure occurs when a competitive market fails to bring about an efficient allocation of credit. In an idealized credit market, loans are traded competitively and the interest rate is determined through supply and demand; therefore, the credit market will attain Pareto efficiency. However, credit markets also diverge from the idealized market because information is imperfect. The absence of good information may explain why lenders choose not to serve some individuals.

Various definition of credit rationing were provided by (Jaffee and Stiglitz 1990) as follows:

1. Interest rate of price rationing. A borrower receives a smaller loan than desired at a given loan rate. If the borrower needs to get more loans, he should pay a higher interest rate (type I).
2. Divergent view rationing (type II).
3. Redlining. A situation in which a borrower is totally excluded from the credit markets because of a lack of collateral and not enough future cash flow to meet the demand for credit (type III).
4. Pure credit rationing. A situation in which some individuals obtain loans while apparently identical individuals who are willing to borrow at precisely the same terms do not (type IV).

In general, many authors who have focused their worked on the explanation of credit rationing can be conveniently classified into two categories: (1) literature which is based

on the various loan market imperfections, and (2) recent literature which is based on imperfect information (Jaffee and Stiglitz, 1990: 849).

This next section will focus on the second of these theories of credit rationing.

### 2.4.1 Asymmetric Information

Asymmetric information itself was proposed by (Akerlof 1970) to explain the asymmetric distribution of information between market participants. He used the example of car markets in which sellers gain an advantage from having better information/knowledge about the quality of the products they sell. In contrast, buyers have no complete information about the quality; therefore, they pretend that the cars on the markets always in a good condition.

Information problems that cause market failure from the perspective of constrained Pareto efficiency are: adverse selection, moral hazards and monitoring costs ((Bebczuk 2003). Meanwhile, (Furubotn and Richter 2000) noted that one distinguish between two forms of moral hazards in the principal-agent relationship: a) hidden information where the agent has acquired some information that the principal does not have, and b) hidden action where the effort level of the agent is unobservable by the principal.

### 2.4.2 Adverse Selection Stiglitz-Weiss Model

Adverse selection refers to the situation when the agent holds private information before the relationship begins (Stadler and Castrillo 2001). In the financial markets, adverse selection occurs when the lender is not capable of distinguishing between borrowers with different risks when allocating credit, and it appears before the lenders disburse loans. The lender prefers to provide the safest loans while the borrowers prefer the riskiest. The borrowers take advantage when the lender lacks information about their project risk (Bebczuk 2003).

In the case of describing credit rationing, (Stiglitz and Weiss 1981) investigated adverse selection problems which are principally based on two main assumptions: that lenders cannot distinguish between borrowers with different degrees of risk and that loan contracts are subject to limited liability.

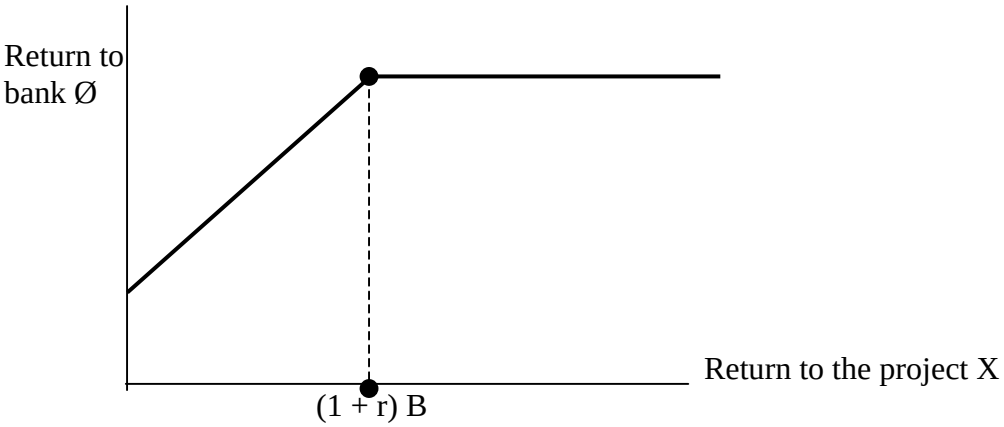
The following explanation focuses on the case in which increasing the interest rate (as price) leads to an adverse selection process regarding the pool of loan applicants (based on the I section of Stiglitz and Weiss). In this model, further assumptions were made to simplify the analysis; all the investments are projected to be the same size.

The return function to the lender:

$$Ø = \min \{ ( 1 + r ), X/B \}, \qquad (2.1)$$

where X is the return to the project, and B is the size of the loan. The return to the lender itself as a function of the project X is a concave function as depicted in Figure 2.4.

Figure 2.4 The Return to the Bank as a Function of the Return on the Project




Source: (Stiglitz and Weiss 1981)

In contrast, the return to the borrower is :

$$\pi = \max \{ 0, X – (1 + r ) B \} \qquad (2.2)$$

With the limitation of liability, the lowest return that the borrower obtains is zero. The profit function of the firm is convex, which implies:

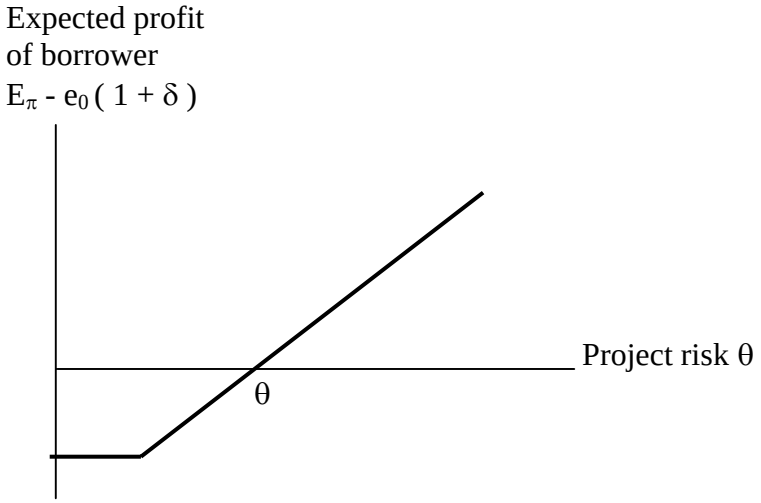
1. Borrowers whose return is riskier have a higher expected profit. The notation for the riskiness of the project is θ. The higher θ shows greater riskiness. The lender demands a collateral that the borrower ( risk-neutral) has to pledge, which is denoted by $e_0$. Projects will be run if :

$$E_\pi > e_0 ( 1 + \delta ) \qquad (2.3)$$

The borrower considers that there is a certain risk level that should be maintained before undertaking a project, $\bar{\theta}$ and that it influences their expected profit. Therefore, the decision will be made to carry out the project as long as $\theta > \bar{\theta}$.

The borrower's expected profit is ($E_\pi - e_0 ( 1 + \delta )$ as a function of $\theta$ and depicted in Figure 2.5

Figure 2.5 Profit of Borrower as a Function of Project Return




Source: Stiglitz and Weiss (1983)

2. An increasing interest rate reduces the expected profit for all types of borrowers. The project with the lowest risk will immediately drop out as a response to increasing interest rates due to the low profit that the project can generate. As a result, the pool of borrowers becomes more risky, and the return of the bank becomes lower. This is the adverse selection effect.

3. Due to the concavity of the lenders' return function, the expected return to the lender is smaller with higher θ. If the expected return to the borrower for high-risk projects is higher, then the expected return to the lender must be lower. Therefore, the total expected return- averaged over all applications for loans- may either increase or decrease when the interest rate *r* is increased.

### 2.4.3 Types and Mechanisms for Measuring the Degree of Credit Rationing

The measurement of degree of credit rationing is challenging work. In order to measure credit rationing appropriately, many empirical results have been investigated by using different approaches. (Petrick 2004) described six approaches to investigating credit rationing:

1. a direct method based on the measurement of loan transaction costs,
2. a direct method based on qualitative information collected in interviews,
3. a direct method based on the credit limit concept,
4. a direct method based on spill-over effects,
5. an indirect method based on econometric household modelling, and
6. an indirect method based on an econometric analysis of dynamic investment decisions.

(Jappeli 1990) categorized the credit-constrained households as those who had their request for credit rejected by financial institutions. Therefore, he studied discouraged borrowers to accomplished his analysis. The discouraged borrowers were used to identify certain households which have a high probability of loans denials and may not apply for a loan because they know that if they do, they will be refused. (Feder, et al. 1990) examined the experience households had with credit markets by directly collecting information. Borrowing households were asked if they would have liked more institution credit at the going interest rate than the amount they were actually granted. Non-borrowing households were asked, about the reason for not borrowing. The authors then classified their respondents into two groups: credit-constrained and non-credit constrained households. The households categorized as credit-constrained refer to the borrowers who received loans lower than the amount demanded, and the non-borrowers who could not obtain credit. Conversely, the households were categorized as non-credit-constrained if they received the same loan that they demanded. The direct method approach on qualitative information collected during a survey is the one common method in assessing credit rationing. Many authors applied this method in different countries, i.e, (Zeller 1994) in Madagascar who focused not only on formal credit groups but also

informal lenders; Freeman, et al. (1998) in the East African highlands; and Petrick (2003) in the rural areas of Poland.

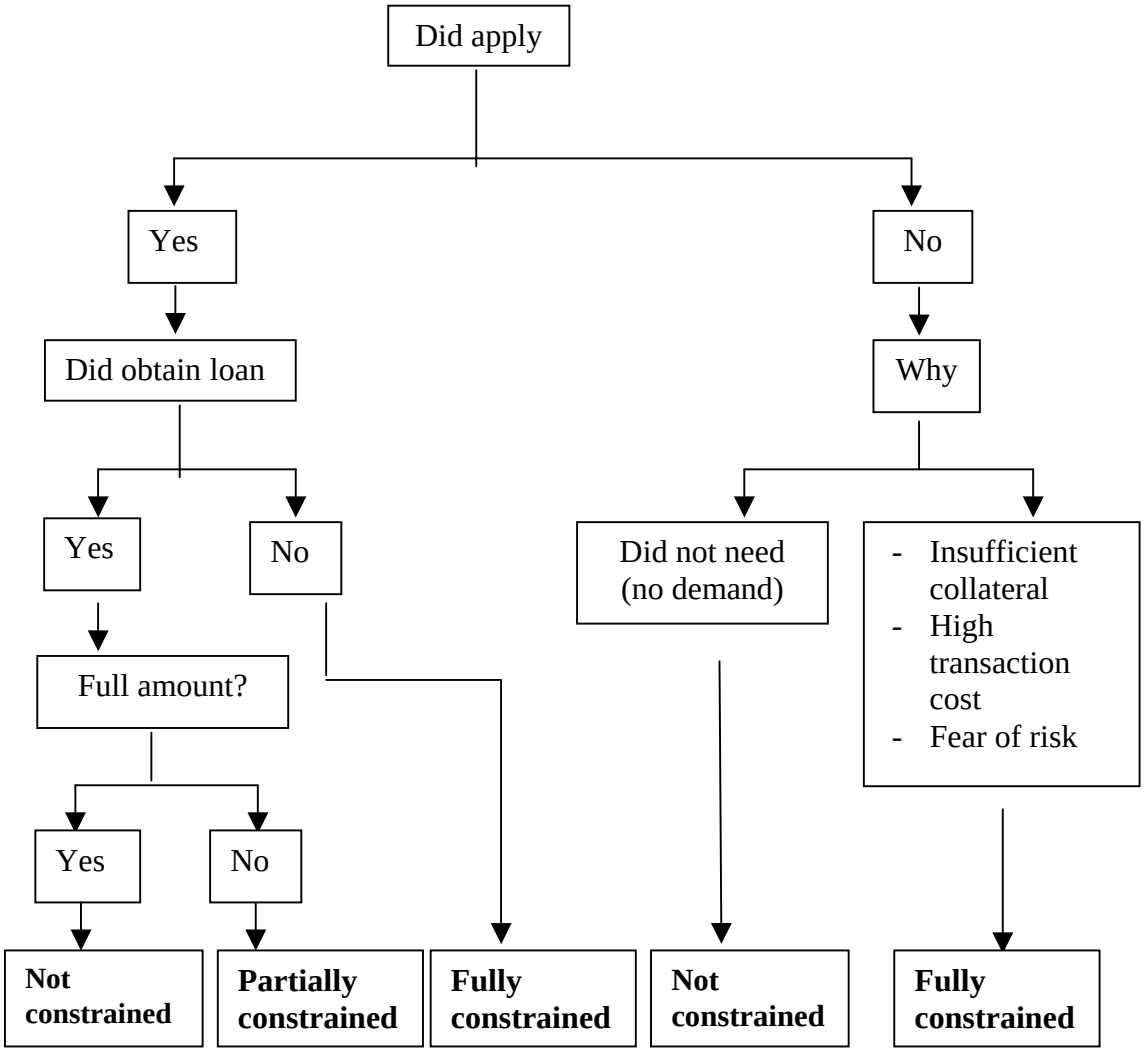
(Barham, et al. 1996) followed the work by Feder et al. (1990) by exploring the latent loan demands of households by asking about their credit markets experiences with some additional approaches (borrowing needs, experiences, and perceptions). They took a problem of one respondent group into account, those who did not apply for credit.

Some of the non-applicants truly had no demand at the perceived contract rate; and others would have demanded a loan, but the transaction cost of getting a loan was too expensive; or they believed that the banks would reject them for reasons of insufficient collateral. To deal with this problem, they categorized their respondents into three groups:

1. Fully constrained: The households which either applied and were rejected or did not apply due to: (a) insufficient collateral or the inability to document sufficient asset holdings to secure or collateralize the loan; (b) high transaction cost, i.e., the cost of obtaining property titles, compiling enterprise projects, or paying other loan fees made the effective cost of the loan prohibitive; and (c) the fear of risk specifically the loss of their wealth prevented them from pursuing a loan.
2. Partially constrained: Households which received a loan but which was lower than requested.
3. Unconstrained: Households which either received the full loan amount or had no interest in a loan.

The description of these classifications is depicted in Figure 2.6

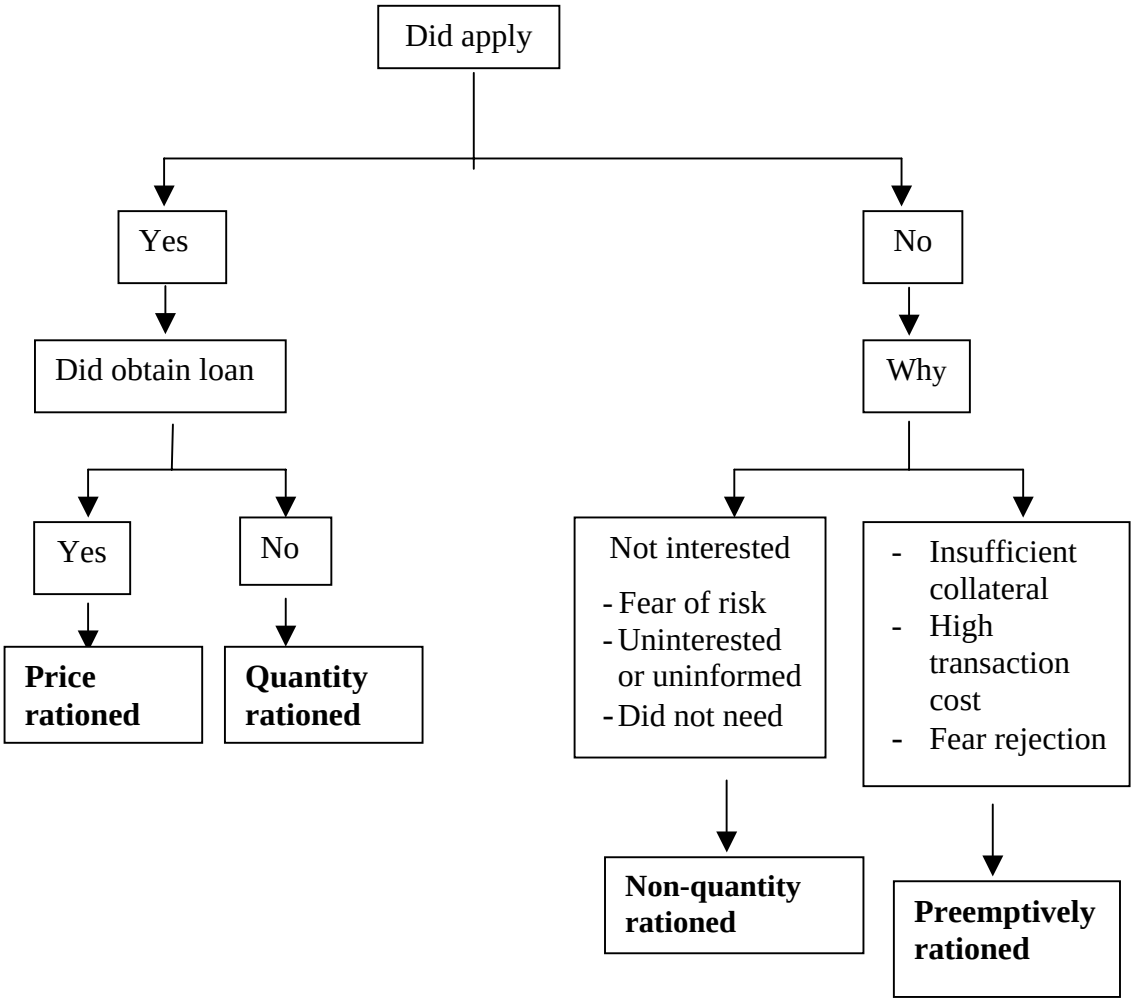
Figure 2.6 Classification of Credit Rationing Borrower According to Barham, Boucher, and Carter (1996)




(Kochar 1997) uses survey data of rationing outcomes and takes loan application as a signal of demand, and then estimates credit access by producers with different levels of wealth. The households which do not apply are assumed to be uninterested or unconstrained.

(Mushinski 1999) introduced a new term of credit-rationed households called *pre-emptively rationed.* In an investigation of credit rationing evidence in Guatemala, the survey asked if respondents had applied to and been rejected by a formal lender. Detailed classification of different types of respondents is shown in Figure 2.7.

Figure 2.7 Classification of Credit Rationing According to Mushinski (1999)




Rejection was taken as evidence of a positive demand and zero supply; therefore, the rejected respondents were classified as quantity rationing. However, Mushinski then explained further that in the presence of positive transaction costs, not having been rejected may be insufficient justification for classifying a respondent as price rationed. For this reason, respondents who did not apply to a formal lender were asked the reason they did not seek a formal loan.

Pre-emptively rationed refers to the household which might not apply for a loan in the first place because they do not expect to receive a loan offer.

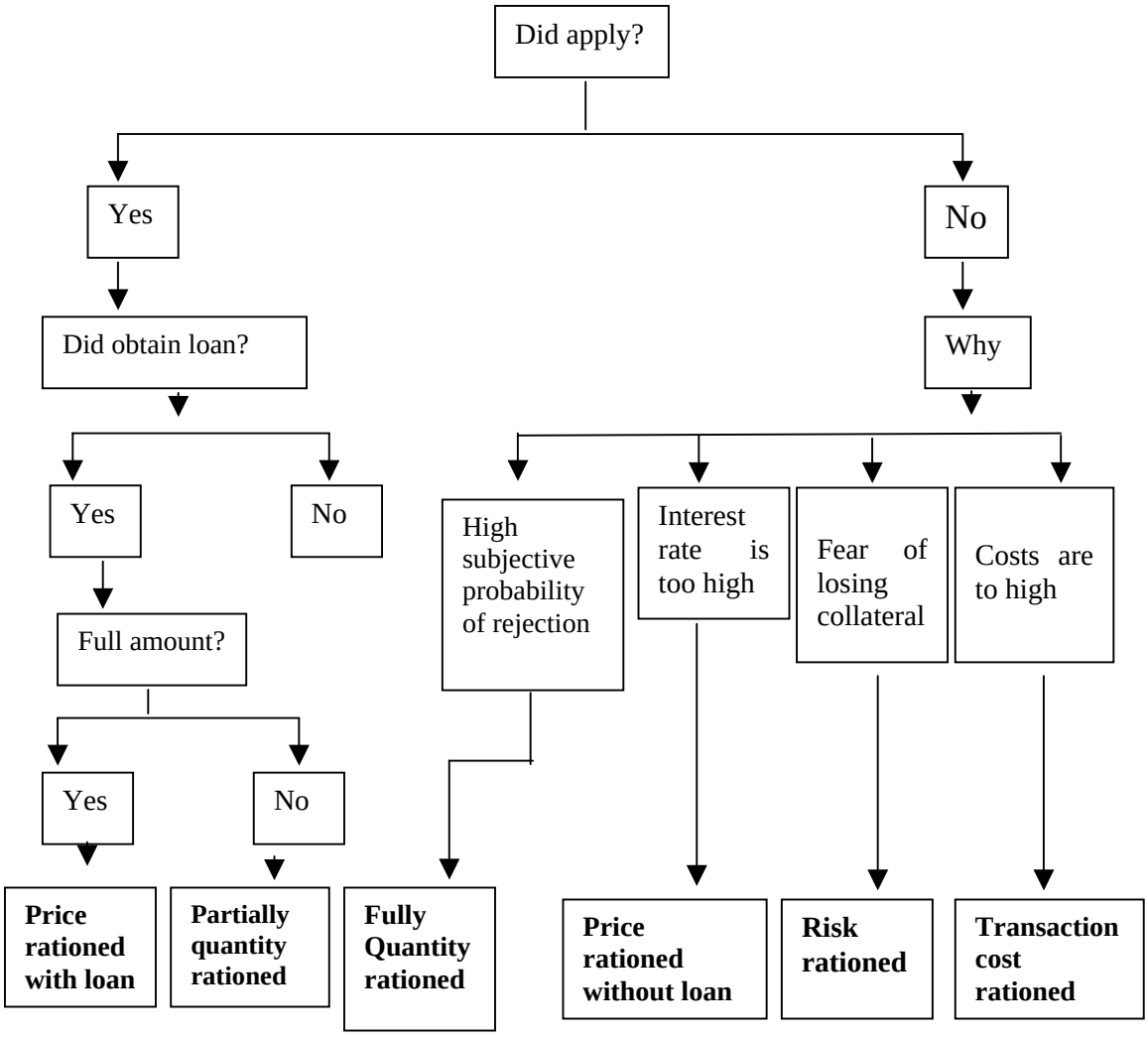
The different approaches that have been explained previously for detecting credit rationing only consider price and quantity. (Boucher 2002) offered a different approach with the assumption that farmers are risk-neutral to simplify the econometric analysis. The derivations of a farmers' credit-demand schedule and endogenous-rationing amounts are based on expected returns. The more intuitive assumption of risk aversion implies several important consequences. First, for a given cost, risk-averse farmers strictly prefer credit contracts that offer greater implicit insurance or less income variability across states of nature. Second, the way lenders solve the incentive problem associated with moral hazard depends on the wealth of each borrower. As risk-rationed farmers, they would not be classified as quantity-rationed because they are offered a contract. Classifying them as price-rationed, is not satisfactory; therefore, Boucher suggests separating the risk-rationed farmers into different classes.

The classifications of the rationing mechanism based on Boucher's approach are as follows:

1. Price rationed with loan. Households apply for a loan and receive the full amount of their application.
2. Partially quantity rationed. Households apply for a loan and receive less than the full amount their application.
3. Fully quantity rationed. Households apply for a loan and are rejected or do not apply because the subjective probability of rejection is too high.
4. Price rationed without loan. Households do not apply for a loan because of the higher interest rate.
5. Risk rationed. Households do not apply for a loan because of the fear of losing collateral.
6. Transaction cost rationed. Households do not apply for a loan because the transaction costs are too high.

This classification can be seen in Figure 2.8.

Figure 2.8 Classification of Credit Rationing According to Boucher (2002)




(Maldonado 2004) proposed two different classifications of households. Those households which do not apply for loans can be categorized as follows:

1. Credit constrained

(a) Risk averse. Households claimed that to borrow is very risky and they do not like being indebted, or they feel uncomfortable having debts.

(b) High cost. Households considered that loans were available but felt the contract terms were not favourable, (i.e., high interest rates, too many requirements, short-term maturity) given their own budget and preferences.

(c) Self Selected Out. Households think that even if they applied they would not obtain a loan or that lenders are not available in their region.

2. Unconstrained (non quantity rationing). Households claimed that they did not need a loan. They faced either few budget restrictions or such low-productivity opportunities that they did not require additional funds.

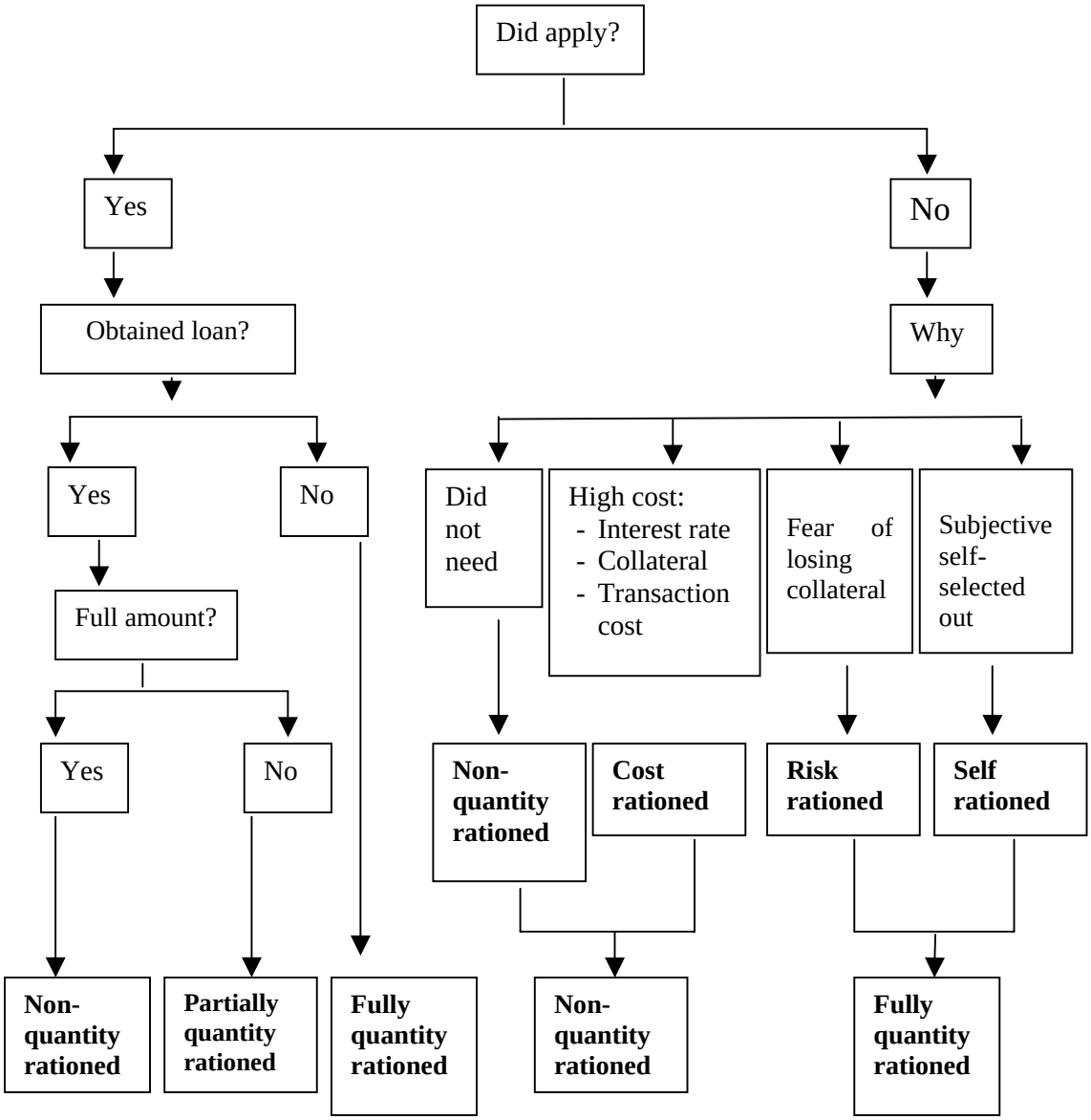
Households which applied to certain credit institutions can be categorized as follows:

1. Fully quantity rationed. The applicants' household was rejected.
2. Partially quantity rationed. The households obtained a loan but received less than the amount for which they asked.
3. Non-quantity rationed. Households received the amount they asked for (or more).

Maldonado considers transaction costs to be part of the determinants of credit rationing. The households which do not apply because the cost of getting a loan is expensive can be considered to be price-rationed instead of quantity-rationed.

Maldonado suggested the classification of credit rationing households as depicted in Figure 2.9.

Figure 2.9 Classification of Credit Rationing According to Maldonado (2004)




## 2.5 Concepts of Access to Credit Markets

The terminology for access to credit and participation in the credit market is often confused and interchangeably used by many researchers who intend to analyse the performance of credit markets. However, an innovative theory was introduced by (Diagne, et al. 2000), and (Diagne and Zeller 2001) to clearly differentiate between access to credit and participation in credit markets. The definition of access to credit that is used, following Diagne and Zeller (2001), is that a household has access to a particular source of credit if it is able to borrow from that source, although it may for a variety of

reasons choose not to. The extent of access to credit is measured by the maximum amount that can be borrowed (its credit limit - third approach to investigating credit rationed based on Petrick, 2004).

The following section presents the concept of access to credit based on the work of (Diagne, et al. 2000): 12-14). In the loan transaction, the lender chooses the credit limits and the amount they want to be repaid while the borrower chooses the amount to be borrowed within the range set by the lender. The lender chooses the pair ($b_{max}$, $\mathbf{R}^1(.)$), where $b_{max}$ is the maximum amount he is willing to lend, and $\mathbf{R}^1$ is a repayment function

$\mathbf{R}^1 : [0, b_{max}] \rightarrow \Re$ specifying how much, when, and under what conditions he wants to be repaid for any given loan size $b \in [0, b_{max}]$ borrowed. In other words, the lender offers the contract ($b_{max}$, $\mathbf{R}^1(.)$) to the borrower who accepts or rejects it by his choice of $b^* \in [0, b_{max}]$. The contract is accepted if $b^*$ is strictly positive and rejected if $b^* = 0$. Once the loan has been disbursed, the borrower chooses the timing and amount(s) of the actual repayment(s) $\mathbf{R}^b$. Default occurs when $0 \leq \mathbf{R}^b < \mathbf{R}^1(b^*)$. In this choice of $b_{max,}$ the lender is constrained himself by the maximum amount he is able to lend to any borrower, $b_{max}$, i.e., the total loan granted to all clients is given by $b_{max}$* n where b is the average loan size and n is the number of clients. The possibility of default and lack of effective contract enforcement give lenders incentive to restrict the supply of credit even if they have more than enough to meet a given demand and the borrower is willing to pay a high enough interest rate (Stiglitz and Weiss 1981). Therefore, from the borrower's point of view, the relevant credit limit on supply is not the maximum the lender is able to lend, $b_{max}$, but rather the maximum the lender is willing to lend, $b^a_{max}$.

The wedge between the maximum the lender is willing to lend to a given borrower and the maximum he is able to lend (i.e., the difference between $b^a_{max}$ and $b_{max}$ ) represents the extent of credit rationing that arises because of information asymmetry and contract enforcement problems.

## 2.6 Assessing Impact of Credit

The substantial impact of access to credit, particularly in rural areas, is increasing human welfare through the adoption of new technology that contributes to higher productivity, income generation, food and calorie consumption, and improved human capital by providing better education. (Sharma and Buchenrieder 2002) categorized two different important impacts of credit: investment-led benefit impact studies and insurance-led benefit impact studies.

Investment-led benefit impact studies compare households or individuals who have access to financial markets with those who do not. The comparison is directed at controlling various factors that simultaneously affect the households' welfare. The various studies that can be classified in this study include: impact on assets-income-production, impact on food security, and gender-based impact.

The insurance-led benefit impact studies focus on two strands. The first type of study focuses on the affect of households' access to credit in order to smooth consumption when they face income or expenditure shock. The second type focuses on the investigation of the type of economic activity along with access to financial markets.

Previous studies provide convincing evidence that access to credit can have some positive impacts on increasing welfare in rural areas (Carter 1989; Feder. et al. 1990; Freeman. et al.1998; Khandker and Binswanger,1995; Zeller et al. 2001; Amin, Rai, and Topa 2003). Most of these studies have focused on the impact of productivity and the adoption of technology such as high-yield varieties, and the use of fertilizer. For their econometric analysis, most of the studies utilize a selection bias model. The interesting results from those studies are the methodology approaches and the ways to distinguish between farmers' credit constraints and non-credit constraints, as was discussed in the previous section.

Some studies (Feder 1985; Blackman 2001) focus on the consequences of rationing for the productivity of small farmers and technological change. Yaron (1992) concluded that many small farmers in rural areas have limited access to credit and that credit rationing results in less investment in agriculture and constraints on agricultural growth.

Anderson, Locker, and Nugent (2002) try to extend this and emphasize the idea that a household's access to credit not only affects production and consumption activities but also impacts on the management and decisions about common pool resources. The positive relationship between access to credit and common pool resources can be achieved through a strengthened informal agreement about the management of resources or greater access to non-degradation production and consumption choices. Therefore, strong credit institutions have an important role in controlling the economic activities of their clients. A two-stage, least-squares fixed-effect model (Zeller et al., 2000) explains that in Madagascar improved access to credit markets promotes agricultural intensification and preserves soil and forests.

Maldonado (2004) investigated the impact of the households' credit rationing on land use decisions in El Salvador and concluded that increasing access to credit will lead to further pressure on land due to the misspecification problem. Therefore, he applied another model (Switching Regression Model) which distinguished between credit constrained and non-credit constrained households. The result is more reliable in explaining the behaviour of households' credit rationing in which households use their access to formal credit to increase the scale of their agricultural activities. He concluded in the case of the households' credit rationing there was a positive impact respecting the amount of loan on the land pressure. The higher the amount of money borrowed, particularly from the formal credit market, the larger area that was cultivated.

Detailed information related to the different outcome of households' access to financial markets can be seen in Table 2.1.

Table 2.1 .Microfinance and Its Impact on Welfare

| | Capital | | | | |
|---|---|---|---|---|---|
| | Human | Physical | Social | Income | Environment |
| Berger (1989) | | | ± | ± | |
| Diagne and Zeller (2001) | ±[c] | | | ±[f] | |
| Hashemi, Schuler, and Riley (1996) | | | ?g | | |
| Khandker (1998) | | | ± | | |
| Lund and Fachamps (1997) | | | +[h] | | |
| Maldonado (2004) | | | | | ± |
| McNelly and Dumford (1998) | ±[i] | | | + | |
| Morduch (1998) | | | - | | |
| Mosley and Hulme (1998) | | | | +[k] | |
| Osmani (1998) | | | ± | | |
| Nuryartono (2005) | | + | | | ±[o] |
| Pallen (1997) | | | | | + |
| Petrick (2003) | | | | + | |
| Pitt and Khandker (1996, 1998) | | | | + | |
| Schreider (1996) | ± | | | + | |
| Schreider and Heidhues (1993) | | ±[m] | | + | |
| Schreider and Pfaff (1997) | ± | + | ± | | |
| Zaman (1998) | | | ± | | |
| Zeller (1995) | + | + | | + | |
| Zeller, Diagne, and Mattaya (1998) | | ±[n] | | + | |
| Zeller et.al (2000) | | | | | + |

Source: Sharma and Buchenrieder (2002:231) with some additional of information created by the author
Notes : + indicates a positive welfare effect, ± indicates an equivocal result, and – indicates a negative result.

o = a detailed explanation of the results can be seen in the chapter 7.

## 2.7 Conceptual Framework and Analytical Approach to Determine Credit Constraint

Figure 2.11 shows the conceptual framework which is used to answer the research questions and guide the empirical analysis. The analysis starts with the different land right systems that exist in the research area. A land right system is influenced by different processes for acquiring land, population density, development of agricultural markets, and the socio-economic and political conditions. A further step of analysis resumes that the different types of land rights will have different effects on tenure security. For the purpose of this study, the tenure security indicators used refer to those proposed by (Place, Roth *et al.* 1993). Principally, there are three different degrees in valuating tenure

security: breadth, duration, and assurance. We focus on the assurance indicator which can be seen on the basis of the different types of land titles along with different type of land acquisition.

The next step is the analysis of the determinants of households' access to and participation in credit markets. Both formal and informal types of credit markets exist in the research area and need to be analysed. The definition of access to credit that is used, following Diagne and Zeller (2001), is that a household has access to a particular source of credit if it is able to borrow from that source, although for a variety of reasons it may choose not to. The extent of access to credit is measured by the maximum amount that can be borrowed (its credit limit). If this amount is positive, the households are said to have access. The independent variables that are hypothesized as determinants of households' access to credit markets reflect supply-side indicator variables such as wealth status, education or titled land which can be easily observed by the lender when screening loan applicants for creditworthiness.

Another important definition is the households' participation in either the formal or the informal credit market. A household is said to be participating in a specific market segment if it borrows from that source of credit. In this research paper, both definitions will be applied. The important role of land tenure security will be tested to prove the hypotheses that a land title has a significant effect on the household's access to and participation in credit markets, particularly in the formal credit markets.

The households' access to land and credit are simultaneously used to analyse the adoption of technology. Two types of advanced technology, fertilizer and pesticides, are used as indicators of technology adoption, particularly in the lowland area which is devoted to paddy. (Feder, et al. 1985) conducted a comprehensive literature survey on the adoption of agricultural innovations. Factors that have been frequently identified as being influential in determining the adoption of agricultural technology are: (1) farm size, (2) risk exposure and capacity to bear risks, (3) human capital, (4) labour availability, (5) credit constraint, (6) tenure, and (7) access to a commodity market. All of those factors are taken into consideration in the analysis. It is assumed that intensive technology has a

positive impact on resource management by reducing people's need to encroach into forest areas.

Further analysis is directed at answering research questions related to the impact of households' credit constraints on the decisions about land use, particularly in the upland areas, in order to understand the issue of environmental pressure.

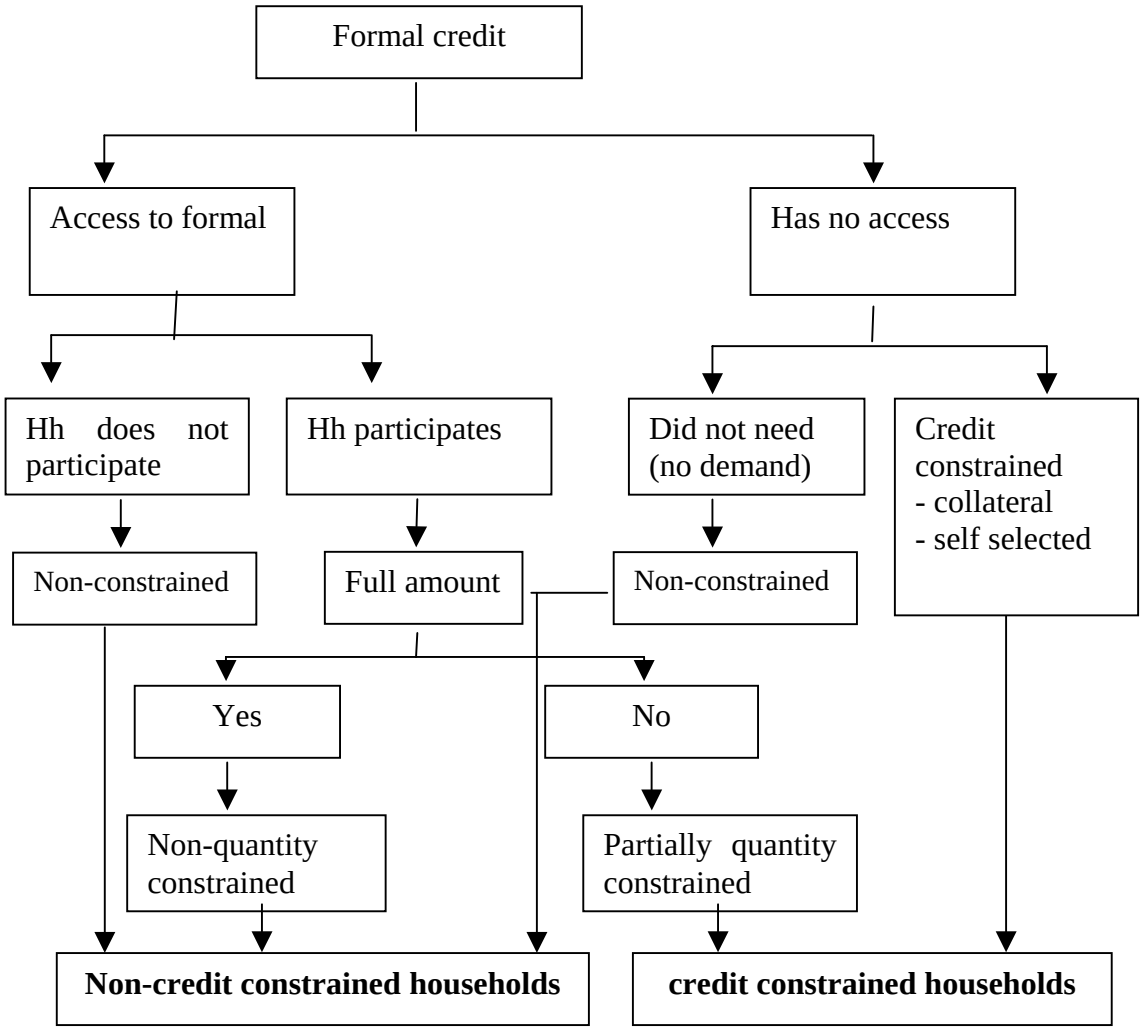
This section explains the approach for categorizing households as being credit-constrained in formal credit markets which is used for further analysis. Figure 2.10 depicts the approach.

To identify the existence of credit-constrained households, it is not enough to observe the presence or absence of loans. The households which do not borrow from any sources cannot automatically be categorized as credit-constrained. At the same time, the households which do borrow money may not necessarily be categorized as non-credit-constrained as they may wish to borrow more at the prevailing market conditions but are denied by lenders to do so.

To uncover the complexity of determining whether households are credit-constrained, two approaches were applied simultaneously: first, a direct approach based on credit markets experiences: and second, a direct method based on the credit limit concept.

Those who had access, were asked whether they had applied for credit or not. The households which had access but did not choose to apply because of some reason, e.g., no need for a loan, are categorized as non-credit-constrained households. Those who did obtain a loan but received less than the amount they had asked for are considered to be credit-constrained, but only partially. Those who asked for a loan and obtained it and received the full amount they asked for are in this case, categorized as non-credit-constrained. The term "participation in credit markets" refers to a situation in which households borrowed money from the formal credit markets.

Figure 2.10. Analytical Approach for Identifying Households Constrained in the Formal Credit Market




Note: Hh = household

In turn, households which had no access to formal credit markets are not necessarily constrained. We asked the reason why they had no access. The answer was used to classify households as credit-constrained or non-credit-constrained. The households were categorized as non-credit constrained if they claimed no need of a loan and they did not face any liquidity constraints.

In contrast, households were categorized as credit-constrained for several reasons, e.g., if they answered lack of collateral which means that the households are aware that even though they want to be involved in the formal credit market, a lender would not lend them money because they do not have sufficient collateral.

Major hypotheses to be tested included:

1. Secure property rights to land facilitates the households' access to and participation in the formal credit institutions (markets).
2. There is segmentation between the formal and informal credit markets in targeting clients.
3. The amount of money borrowed from the formal credit institutions has a significant effect on the adoption of agricultural technology.
4. Human capital, social capital, and physical capital have significant effects on the adoption of technology.
5. There is different behaviour between credit-constrained the households and non-credit-constrained households related to land use decisions.

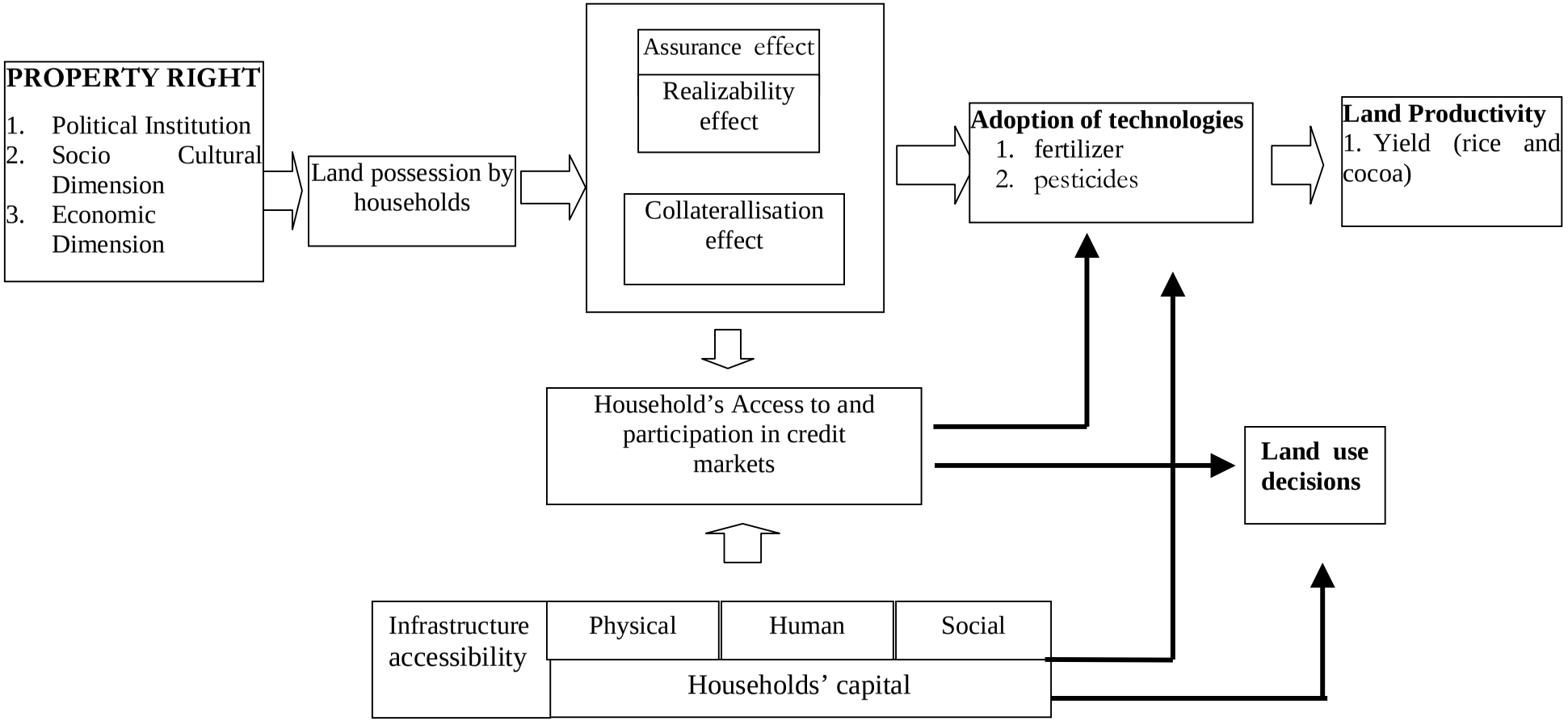



**Figure 2.11 Conceptual Framework**

# 3 Methodology

## 3.1 Sampling Frame and Selection of Households

As part of the multidisciplinary and collaborative research programme STORMA, the sampling frame which was used in this research is based on the common sampling frame that has been used for all social science subprojects in the STORMA programme (Stability on Rain Forest Margin). Details of the procedure for selecting the village and household samples are described in (Zeller, et al. 2002).

The population for the study consisted of all of the households living in the 117 villages surrounding the Lore Lindu National Park, which are divided into five sub-districts. Socio-economic information for concerning the households in 115 villages, which was provided by ANZDEC, was used as a main source of base line data for selecting further households. The sampling method that was used was stratified random sampling. It was selected for two reasons: (1) this procedure allows the analyst to make sure that infrequent types of elements among the population will be included in the sample, and (2) the efficiency is higher compared to simple random sampling (Zeller et al. 2002,: 8).

Three important variables were developed as the main criteria to create village strata as follows:

1. Proximity of the village to Lore Lindu Park (two sub-groups, Selection Criteria 1)
2. The population density of the village (two sub-groups, Selection Criteria 2)

3. The ethnic composition of the village population (three sub-groups, Selection Criteria 3)

Those criteria were chosen because they reflect some hypotheses about the factors which influence stabilization and destabilization of the forest margin areas that will be investigated by each of the sub-projects.

Table 3.1 Absolute and Relative Frequency of Villages in the Population and in the Stratified Random Sample

| No of strata | SC1: close to park | SC2 population density | SC 3: ethnicity | Abs. frequency in population | Relative frequency in population (%) | Abs. frequency in random sample | Relative frequency in random sample | Sampling weight for regional extrapolation from village sample to all 115 villages in the re-search area |
|---|---|---|---|---|---|---|---|---|
| 1 | No | Low | Indigenous | 16 | 13.9 | 8 | 10.0 | 1.3910343 |
| 2 | No | Low | Mixed | 7 | 6.1 | 4 | 5.0 | 1.2173913 |
| 3 | No | High | Indigenous | 14 | 12.2 | 8 | 10.0 | 1.2173913 |
| 4 | No | High | Migrant | 9 | 7.8 | 5 | 6.3 | 1.2521739 |
| 5 | No | High | Mixed | 11 | 9.6 | 6 | 7.5 | 1.2753623 |
| 6 | Yes | Low | Indigenous | 24 | 20.9 | 20 | 25.0 | 0.8347826 |
| 7 | Yes | Low | Migrant or Mixed | 9 | 7.8 | 8 | 10.0 | 0.7826087 |
| 8 | Yes | High | Indigenous | 4 | 3.5 | 3 | 3.8 | 0.9275362 |
| 9 | Yes | High | Migrant | 5 | 4.3 | 4 | 5.0 | 0.8695652 |
| 10 | Yes | High | Mixed | 16 | 13.9 | 14 | 17.5 | 0.7950311 |
| All | | | | 115 | 100 | 80 | 100 | |

Sources: Zeller et al. (2002)

The 115 villages were segregated into 12 strata based on three selection criteria. However, after inspection of the data, only ten strata were created due to one strata being empty and one strata consisting of only one village. Table 3.1 presents the sample size for each strata.

In the next step for choosing household samples from these strata, the number of randomly selected villages was twelve. The 301 households from 12 villages were randomly selected as our sample. The number of those selected households in every village was chosen according to the share in the overall strata with some adjustment according to village size and proximity to the National Park (Schwarze, 2004). The number of sample households from each village can be seen in Table 3.2.

Table 3.2 Sample Frame and Selection of Households

| District | Village | Strata | Number of selected households |
|---|---|---|---|
| Lore Utara | Watumaeta | 6 | 20 |
| | Wuasa | 10 | 27 |
| | Wanga | 6 | 17 |
| | Rompo | 6 | 16 |
| Palolo | Sintuwu | 8 | 25 |
| | Berdikari | 5 | 21 |
| Sigi Biromaru | Maranata | 3 | 32 |
| | Pandere | 10 | 31 |
| | Sidondo II | 4 | 33 |
| Kulawi | Bolapapu | 9 | 32 |
| | Lempelero | 7 | 30 |
| | Lawe | 2 | 17 |

Source: Zeller et al. (2002)

## 3.2 Data Collection

### 3.2.1 Primary Data

The household survey was conducted by using formal questionnaires. The questionnaires were pre-tested in Bora village, which was not part of the village sample. The aim of the pre-test was to gain an understanding of the questionnaires through direct interviews with households which were conducted by 12 selected enumerators. The finalization of the questionnaires was carried out after the pre-test in response to some input from the respondents and enumerators and the direct observations of senior field staff during the pre-test.

Data collection was executed in two phases. The first phase covered the four months from December 2000 to March 2001, and focused on household composition, land and livestock possession, and the use of inputs and outputs for agricultural activities. The second phase covered the three months from August to October 2002, and included some additional detailed questions related to access to credit and land ownership. In the second survey, the questions covered some changes in household composition, possession of land, and livestock. The sample households in the second survey dropped to 293 because five households moved and three refused to be respondents.

An in-depth analysis was carried out to discover important information from the first and second household surveys. This survey was carried out between September 2003 and

February 2004. Targeted respondents were from different levels (households, villages, and institutions in the district and the province) which were related to the main issues concerning land and credit markets. The aims of this in-depth survey were to:

1. investigate land ownership and land accumulation by the migrant as well as the land tenure system in the research area.
2. investigate the mechanism of different credit markets exist in the research area (informal lender and formal institutions).

### 3.2.2. Secondary Data

Secondary data was collected to reveal the relationship between the existing land policies and credit market policies as well as agricultural activities. The main data sources were the different government institutions at the district and province levels.

## 3.3 Data Entry and Cleaning

The data from the households survey was entered twice by different enumerators at the University of Tadulako, Palu using SPSS. These two versions of entered data were then compared with each other to ensure consistency. In the cases of inconsistencies, questionnaires were needed to clarify the process of the data entry. The next step in data management was to clean all the entered data which consisted of examining the data for missing values, wild codes, inconsistencies, and extreme values.

## 3.4 Methodology Applied in Descriptive Analyses

Descriptive statistic related to the data analysis refers to (Mason and Lind 1996) and (Anderson, et al. 2002)). Various descriptive statistics were used to present information about variables, such as:

1. The percent of frequency distribution is a tabular summary of data showing the percent of frequency in each class. This tabular summary is divided into two forms, frequency tabulations and cross-tabulations.
2. Measures of central tendency which consist of minimum, maximum, and average values of observations.

3. Measures of variability. Two types of the measurements of variability are variance and standard deviation. Variance is based on the difference between the values of each observation ($x_i$) and the mean. The standard deviation is defined as the positive square root of the variance.

4. An independent t-test was applied to compare the mean values of the two groups. The comparison provides a statistic for evaluating whether or not the difference between the two means is statistically significant. We used Levene's test for equality of variance. In the case that equal variances were not significant, we chose t-test results in which variance homogeneity can be assumed.

5. Analysis of variance (Anova) was applied to compare mean value of more than two groups.

All descriptive analyses were analysed using a SPSS software package.

### 3.4.1 Poverty Index

To accomplish our analysis, poverty groups were used as welfare indicators in the various econometric models in the following chapters. Households were divided into terciles groups: poorest, poor, and less poor (Zeller, 2001) based on the poverty index. To generate the index, a method developed by (Zeller, et al. 2002d) was used which involved principal component analysis to select and eventually aggregate various indicators of poverty into a (0.1) normally distributed poverty index. Details of this method, including sampling and questionnaire design, are reported in (Henry, et al. 2001).

### 3.4.2 Social Capital Index

Schwarze (2004) created an index variable for measuring social capital. He followed the work of (Grootaert 1999). The procedure for creating a social capital index can be explained as follows:

The heads of households and spouses were asked about being involved in local organisations. The three most important organisations were mentioned and the result of the number organisations produced the density of the membership. An additional question was asked related to the process of decision-making. They were asked

subjectively whether they were ‘very active,’ ‘somewhat active,’ or ‘not very active’ in the process of decision-making. This response was scaled from 2.0 (very active) to 0 (not very active), and averaged across the three most important organisations for the heads of households and spouses. The resulting index was re-scaled from 0-100.

### 3.4.3 Lorenz Curve and Gini Index

The analysis of land distribution among villagers is important because it helps to determine the degree of inequality among them. Moreover, in the rural areas, issues of land inequality are very sensitive and potentially lead to conflicts among the villagers. Two of the common tools for analysing inequality among societies, particularly regarding income distribution, are the Lorenz Curve and the Gini Coefficient. However, currently this analysis is widely utilized not only for analysing income distributions but also for many issues related to aspects of distribution and inequality. The Lorenz curve was applied to provide a graphic representation of the degree of inequality of land distribution in the research area.

The Gini coefficient was developed to measure the degree of concentration (inequality) of a variable in a distribution of its elements. It compares the Lorenz curve of a ranked empirical distribution with the line of perfect equality. This line assumes that each element makes the same contribution to the total summation of the values of a variable. The Gini coefficient ranges between 0, where there is no concentration (perfect equality), and 1, where there is total concentration (perfect inequality).

The area of concentration between the Lorenz curve and the line of perfect equality expresses a proportion of the area enclosed by the triangle defined by the line of perfect equality and the line of perfect inequality (see Figure 3.1). The closer to 1 the coefficient is, the more unequal is the distribution. The formula to calculate the Gini coefficient is (Jenkins, 1999):

$$G = 1 + \frac{1}{N} - \left( \frac{2}{m \cdot N^2} \right) \cdot \sum_{i=1}^{N} (N - i - 1) \cdot Y_i \qquad (3.1)$$

where N is the number of households, $Y_i$ denotes the total land owned of household I and m is the mean of total household land owned. The households are ranked in an ascending order of $Y_i$.

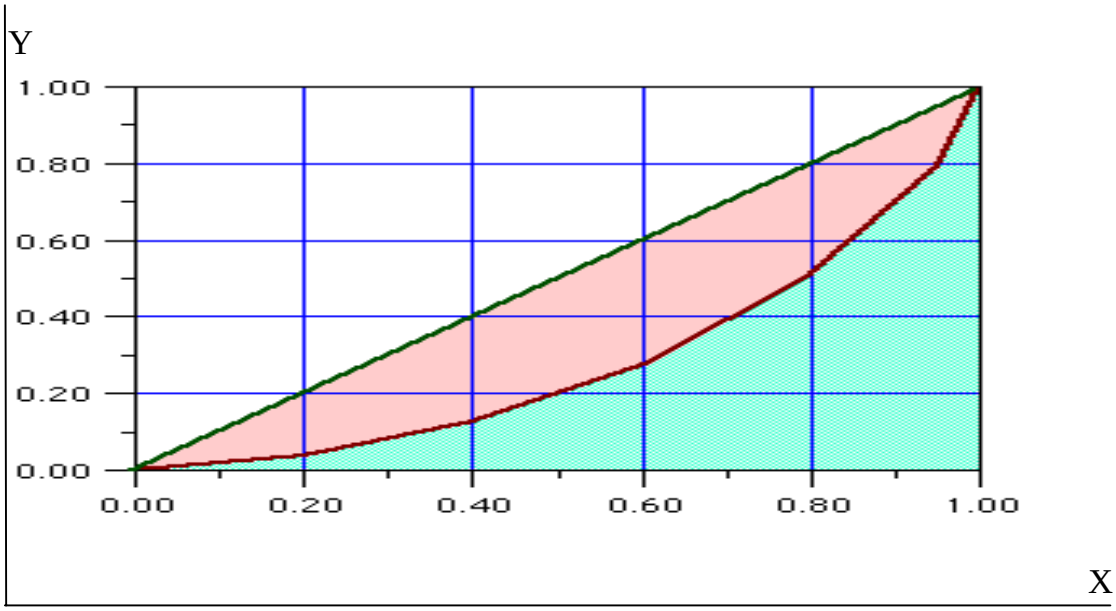



Figure 3.1 Lorenz Curve

Where X-axis is the percentage cumulative number of the households and Y-axis is the percentage cumulative size of land owned.

### 3.5 Methodology Applied in Causal Analyses

Some econometric models applied in causal analyses investigate the underlying factors in determining household access to land and credit markets along with the impact of access to credit on the various outcomes. Several steps should be taken in order to avoid some violation of assumptions, particularly in classical linear regression (CLR) by applying the ordinary least squared (OLS) estimator. The next sub-section provides details about the method used to detect these violations.

### 3.5.1 Detecting Violation of Homoekedasticity Assumption in OLS

One of the important assumptions in the ordinary least squared (OLS) estimation is homoskedasticity; however, this assumption is often violated in economic data, particularly cross-section data (Mukherjee, et al. 1998). The violation of homoskedasticity's assumption is heteroskedasticity which is the variance of the unobservable changes across different segments of the population where the segments are determined by the different values of an explanatory variable (Wolldridge 2003), (Kennedy 2001). For example, not only is the level of money borrowed from credit markets by the rich much higher than that of the poorest, but it is also more varied. The implication of heteroskedastic errors is that the precision in the estimation of the coefficient is no longer the best. The least square estimators are not the best linear unbiased estimator (BLUE), and it is not possible to perform the t-test and F-test (Mukherjee, et al. 1998): 251-252). (Greene 2000) asserted that heteroskedasticity results in inefficiency of the ordinary least square model.

There are a number of tests in the relevant literature which are directed at detecting heteroskedasticity. The Breusch-Pagan/Cook-Weisberg test is applied in the causal analysis to detect heteroskedasticity, which is provided by STATA 8.0. In the case of a problem of heteroskedasticity, some of the variables are revised through transformation into logarithms or natural logarithm forms.

### 3.5.2 Detecting Violation of Non-multicollinearity Assumption in OLS

Multicollinearity refers to a situation in which there is a perfect linear relationship among independent variables. The consequence of multicollinearity is that the variance of the OLS estimates of the parameters which are correlated with each other is quite large. Therefore, the estimated results of the parameters are not reliable enough and lead to weak hypothesis testing (Kennedy 2001).

Multicollinearity can be detected by utilizing the VIF command in STATA 8.0. VIF stands for Variance Inflation Factor. A variable whose VIF is greater than 10 should be further investigated as it will potentially lead to multicollinearity. The degree of

multicollinearity can be seen from the results of 1/VIF. A tolerance value lower than 0.1 is comparable to a VIF of 10. This means that the variable could be considered to be a linear combination of other independent variables[1]. If there is a problem with multicollinearity, one of the variables which correlates with other variables needs to be removed from the model.

## 3.6 Model Estimation

### 3.6.1 Determinants of Land Possession

An important characteristic in economic surveys of households is that certain variables have a lower, or upper limit and take on the limiting value for a substantial number of households (Tobin 1975). The Tobit model is utilized in order to explain the influential factors in determining land possession taking into consideration three means of acquiring land (forest, family, and purchased land),. Some of the sample households had zero observation concerning on the dependent variables. The Tobit model is used to analyse dependent variables which are limited in their range. Two types of the Tobit models are: a censored model which considers that some observations on the dependent variable, corresponding to known values of the independent variables, are not observable; and a truncated model which considers the case where independent variables are known only if a dependent variable is observed.

In the case of limitation values of dependent variables, OLS estimates are biased; therefore, the Tobit model uses a maximum likelihood estimator (Kennedy 1998; Greene 2000)

The original Tobit model, which was suggested by Tobin who analyzed household expenditures on durable goods taking into account their non-negativity, is:

$y = x\beta + u$ if RHS > 0 (3.2)

$y = 0$ otherwise. The detailed model of land possession is provided in the chapter six.

[1] Several methods for checking multicollinearity are discussed in http://www.ats.ucla.edu/stat/stata/webbooks/reg/. These methods have been applied in the econometric analysis.

### 3.6.2 Determinants of the Access of Households to and Participation in Informal Credit Markets

As previously explained in Chapter 2, there are several methods for assessing the access of households to credit. The definition of access to credit that is used, following Diagne and Zeller (2001), is that a household has access to a particular source of credit if it is able to borrow from that source, even though for a variety of reasons it may choose not to. The extent of access to credit is measured by the maximum amount that can be borrowed (its credit limit). Participation in an informal credit market refers to a situation in which households have borrowed from any type of informal credit institutions.

Separate econometric models are used to explain the determinants of the households' access to informal credit as well as participation.

The dependent variable in this analysis is set up as a 0-1 dummy variable. 1 is for household access to an informal credit market and equals 0 for those who have no access to informal credit. In a separate model, households which borrowed money from an informal credit market are set equal to1 and equal to 0 for households which did not borrow. The predicted values of dependent variables fall mainly within the interval between 0 and 1; therefore, the predicted value of the dependent variable could be interpreted as the probability that households will have access to informal credit as well as that they will participate.

The independent variables which are used for both analyses reflect human capital, the welfare situation of the households, and risk bearing indicators.

As a nature of dichotomous dependent variables, Probit model was chosen as an appropriate model to explain those phenomena.

The Probit model can be formulated in accordance with (Gujarati 1995)

$$Y^*_i = ß'X_i + \mu_i, \qquad (3.3)$$

where

$Y = 1$ if $Y_i >=$, otherwise

$Y = 0$ and

Probability ($Y_i = 1$) = Probability ($\mu > ß'X_i$) = 1-F( $-ß'X_i$ )

where F is the cumulative distribution function for $\mu$.

The ß' are estimated by applying maximum likelihood estimators.

### 3.6.3 Impact of the Access of Households to Formal Credit on the Adoption of Agricultural Technology

To determine the factors that influence the impact of the access of households to formal credit on the adoption of agricultural technology, a selection bias model (Heckman model) along with a recursive model were applied. The following step explains the model:

The first step of the sample selection model is to determine the amount borrowed that is determined by some x variables. Since it is recognised that access to formal loans is an endogenous variable, OLS regression is likely to result in inconsistent estimates. The amount borrowed (AMBORR) is a function of exogenous variables, X and the endogenous access to formal credit A.

$AMBORR = \alpha_2 X + \gamma A + E_2$ ……. (3.4)

The problem arises because unmeasured household level variables affect both the households' access to formal credit and the amount borrowed.

To overcome the problem of endogeneity, a two stage procedure which is a variant of the standard sample selection model can be applied to produce unbiased and consistent estimates of adoption, given that the particular access to formal credit is an endogenous variable.

$A^* = \alpha_1 \nu + E_1$…….(3.5)

$AMBORR = \alpha_2 X + \gamma A + E_2$……..(3.6)

$A^* = 1$ if $A^* > 0$ and A=0, otherwise

Equation 3.5 states that A*, access to the formal credit depends on a set of variables represented in $\nu$. Equation 3.6 states that the amount of money borrowed depends on another set of variables X and the access to the formal loans.

Since the random error term $E_1$ and $E_2$ are likely to be correlated because of unobserved households variables affecting both A and AMBORR, the problem of simultaneity bias arises when equation 3.6 is estimated directly by OLS.

A two-stage procedure can be used to produce unbiased and consistent estimates. The first stage, an estimate A* of A is obtained by the Probit maximum likelihood approach. The dependent variable in this analysis is set up as a 0-1 dummy variable. 1 is for household access to a formal credit market and equals 0 for those which have no access to formal credit. The independent variables reflect some variables which can be observed by the lender such as human capital (age, education, family size), assets (value of assets, land title), and accessibility.

The dependent variable in the second stage of the Heckman model is the amount of money borrowed from formal credit institutions. The amount of money borrowed refers to a three year recall period. The independent variables reflect the demand side and included: human capital, income, area of cultivation as a proxy for economics of scale of agricultural activities, the type of formal credit institutions, and IMR ($\gamma$) which is then used in the second stage to obtain estimates of the amount of borrowed from the formal lender.

$$T = \alpha_3 X + \gamma \text{ PAMBORR} + E_3 \ldots\ldots\ldots\ldots\ldots\ldots (3.7)$$

In a second step of the recursive model, the effect of the amount borrowed on technology adoption is estimated, controlling for other factors such as endowment in production factors, the predicted amount borrowed from a formal credit institution (PAMBORR), human capital, social capital, the distance from a home to a road as a proxy for of access to a market represented by equation 3.7. The dependent variable is the amount of urea applied and expenditure for pesticides, which are analysed in separate model.

### 3.6.4 Switching Regression Model to Determine the Impact of Credit Constraint in Land Use Decisions

There are several stages that can be utilized to test some hypotheses as depicted in the conceptual framework. The first step would be an analysis of determinants of households that face formal credit constraints by using the Probit model. The second step would be

an analysis of the impact of the households' credit constraints on their decisions about land use, particularly in the upland areas that are devoted to cocoa and coffee trees.

The switching regression model (SRM) is used to correct for possible sample selection bias which may arise from other interventions that provide multiple services to farmers in addition to credit. Sample selection bias arises when factors unobserved by the researcher but known to the farmer affect both the choice of technology as well as other decision variables (Fuglie and Bosch 1995). The SRM approach is divided into two stages.

It has been hypothesized that access to credit markets and liquidity constraints have a significant effect on agricultural activities, particularly concerning decisions to cultivate certain crops in certain areas. A Probit model in the first stage will be applied to determine the relationship between a farmer's credit constraint conditions and a number of socioeconomic and credit variables, is employed as follow:

$C^* = \gamma' Z_i + \varepsilon i_{,}$ ……. (3.8)

In equation (3.8), C* is dichotomous (1,0), indicating whether observation i is credit-constrained or not; $Z_i$ represents a vector of explaining variables such as human capital, income of the household, assets of the household, and tenure security; $\gamma$ is a vector of parameters; and $\varepsilon i$ is a random error term.

The excess demand function for credit is not observed, but responses from the surveys are used to determine those households which cultivate cocoa and coffee in upland areas and are either constrained or not constrained by credit. Households are credit-constrained if the demand for credit exceeds the supply of credit, which means $C^* > 0$.

These responses are used to define a criterion function which is an observable: dichotomous variable I where

$I = 1$ ; iff $I^* = \delta' Z_i + \varepsilon_i = 0$ .....…….. (3.9)

$I = 0$ ; otherwise

A Probit maximum likelihood estimation is used to estimate the parameter $\delta$ in equation 3.9. It is assumed that var ($\varepsilon_i$) = 1 since $\delta$ is estimable only up to scale factor.

Land use decision behaviour of the two groups of farmers is modelled by reduced form equations specified by

$A_{cc} = \beta_{1i} X_{1i} + \varepsilon_{1i}$ ; iff $I = 1$

$A_{ncc} = \beta_{2i} X_{2i} + \varepsilon_{2i}$ ; iff $I = 0$ ..... (3.10)

where variables $A_{cc}$ and $A_{ncc}$ represent decision variables concerning the size of land devoted to cocoa and coffee in upland area for credit-constrained and non-credit-constrained households.

$X_{1i}$ and $X_{2i}$ are vectors of exogenous variables,

$\beta_{1i}$ and $\beta_{2i}$ are vectors of parameters, and

$\varepsilon_{1i}$ and $\varepsilon_{21}$ are random disturbance terms.

Applying OLS to estimate the parameters $\beta_{1i}$ and $\beta_{2i}$ in equation 3.10 results in inconsistent estimates because the expected value of the error term conditional on the sample selection criteria is non-zero (Maddala, 1994). The random disturbance terms $\varepsilon_{1i,}$ $\varepsilon_{2i}$ and $\varepsilon_i$ are assumed to have a trivariate normal distribution with zero mean and a non-singular covariance matrix.

Maximizing the bivariate likelihood function for this model is feasible but time consuming (Maddala 1994). Therefore, following Lee (1978), a two-stage estimation method is used to estimate the system in equation (3.9) and (3.10).

The conditional expected values of the error terms $\varepsilon_{1i,}$ and $\varepsilon_{2i}$ are:

$$E(\varepsilon_{1i} \mid \varepsilon_i = \delta' Z_i) = E(\sigma 1_\varepsilon \varepsilon_i \mid \varepsilon_i = \delta' Z_i) = \sigma 1_\varepsilon \frac{\varnothing(\delta' Z_i)}{\phi(\delta' Z_i)}$$

$$E(\varepsilon_{2i} \mid \varepsilon_i = \delta' Z_i) = E(\sigma 2_\varepsilon \varepsilon_i \mid \varepsilon_i = \delta' Z_i) = \sigma 2_\varepsilon \frac{\varnothing(\delta' Z_i)}{1-\phi(\delta' Z_i)}$$

where $\varnothing$ and $\phi$ are the probability density function and the cumulative distribution function of the standard normal distribution respectively. The ratio $\phi/\varnothing$ evaluated at $\delta' Z_i$ for each I is the Inverse Mills Ratio (IMR). For convenience,

$\lambda_{1i} = \varnothing(\delta' Z_i)/\phi(\delta' Z_i)$ is defined for constrained

and

$\lambda_{1i} = \varnothing(\delta' Z_i)/[1-\phi(\delta' Z_i)]$ for non-constrained..... (3.11)

These terms are included in the specification of equation (3.10) :

$A_{cc} = \beta_1' X_{1i} + \sigma_{1u}\lambda_{1i} + \varepsilon_{1i}$ ; if I = 1

$A_{ncc} = \beta_2' X_{2i} + \sigma_{2u}\lambda_{2i} + \varepsilon_{2i}$ ; if I = 0 ..... (3.12)

In the second step of the recursive model (based on the equation 3.12), the effect of the households' credit constraints on land use particularly in the upland areas which are devoted to cocoa and coffee are estimated.

$A_{cc}$ and $A_{ncc}$ denote the total upland areas that belong to the household that are credit-constrained and non-credit-constrained respectively. X is the vector of variables influencing the households decision such as: human capital, the total income of the household, the total area cultivated, and the welfare status of the household. $\beta$ is the vector of the coefficient which is estimated. $\lambda$ is the inverse mills ratio and $\sigma$ is the

vector of the coefficient of the IMR which is also estimated. ε are the new residuals which has zero conditions means.

# 4 Overview of The Research Area

## 4.1 An Overview of Central Sulawesi Province

Central Sulawesi Province is located in the middle of Sulawesi Island. It is the largest province on the island. Covering 68,059.71 $km^2$, the province consists of eight districts (*kabupaten*) and one municipality (*kotamadya*). There are 81 sub-districts and 1440 villages. The province has 523,505 households with 2,195,711 inhabitants. The population density in 2004 was 31 person per $km^2$ (//sulteng.bps.go.id/pop3.htm). Most of the households (74.1%) reported that farming is their main occupation. Table 4.1 shows that poverty is a widespread problem in this area with almost 50% of the total households being categorized as poor.

The research area is located in the vicinity of the Lore Lindu National Park which covers two districts, Poso and Donggala. Poso has 283,378 inhabitants who reside in 242 villages. The population density in 2004 was 16 per $km^2$. There are 70,484 households and 80.8 % of them reported that agriculture is their main source of income. The percentage of poor households is relatively high (46.1%) compared to other districts. Donggala is the largest district in the province. In this district, the total population is 421,912 people living in 265 villages. The population density in 2004 was 40 per $km^2$. The total number of households is 102,285 and 83.0% of them are farm households. Compared to Poso, the share of poor households in Donggala is slightly lower at 41.3%.

Table 4.1 Population, Farm Households and Poor Households, Differentiated by District in Central Sulawesi Province 2002

| District | Number of villages | Population | Number of households | Number of farm households | Number of poor household |
|---|---|---|---|---|---|
| Banggai islands | 164 | 146,399 | 37,037 | 33,048 (89.2) | 28,741 (77.6) |
| Banggai | 240 | 284,430 | 71,244 | 54,121 (75.9) | 41,409 (58.1) |
| Morowali | 221 | 160,149 | 39,371 | 32,095 (81.5) | 21,570 (54.8) |
| Poso | 242 | 283,378 | 70,484 | 56,984 (80.8) | 32,481 (46.1) |
| Donggala | 265 | 421,912 | 102,285 | 84,937 (83.0) | 42,282 (41.3) |
| Toli-toli | 79 | 178,582 | 44,348 | 37,072 (83.6) | 13,994 (31.5) |
| Buol | 77 | 104,118 | 24,302 | 20,430 (84.1) | 8,776 (36.1) |
| Parigi-Moutong | 109 | 340,010 | 73,272 | 61,423 (83.8) | 26,356 (36.0) |
| Palu | 43 | 276,733 | 61,163 | 7,636 (12.5) | 22,823 (37.3) |
| Total Central Sulawesi | 1440 | 2,195,711 | 523,505 | 387,746 (74.1) | 238,432 (45.5) |

Source: Central Sulawesi Province Statistic Agency 2003 (BPS).
Note: Numbers in parentheses are percentages

## 4.2 Geophysical and Climatic Conditions

Based on their elevation above see level (ASL), there are three levels of land in the area. 20.2% of the area of the province has an elevation between 0-100 m and can be categorized as flat land. This area is potentially used as arable land. Land that has an elevation between 101-500m covers 27.2 % of the area of the province. The remaining land has an elevation above 501 m, and this might cover upland fields, hills, and mountains.

Central Sulawesi is influenced by two constant seasons and cool northwesterly and humid southeasterly winds. The humid southeasterly wind blows between April and September and brings a lot of water with it. The cool northwesterly wind blows between October and March and it is characterized by less of rainfall.

The temperatures in the upland and in the lowland areas vary between 22.3$^{o}$ and 23.8$^{o}$ C and 31.1$^{o}$ and 35.3$^{o}$ C, respectively. Humidity in the area ranges between 72% and 82%.

### 4.3 The Role of the Agricultural Sector in the Economic Development

The agricultural sector makes the largest contribution to the economic development in the province. On the average, the share of agriculture in the Regional Gross Domestic Product (GDPR) is more than 40%. Table 4.2 shows that since 1999, the contribution of agriculture has been increasing and this indicates the important role of agriculture in the development process. In 1999, 2000, and 2001, the contributions were 41.1%, 43.4%, and 44.3% respectively. This fact shows that the agricultural sector in Central Sulawesi Province is a major driving force for economic growth. The second important sector in contributing to economic growth are the services.

Table 4.2 Regional Gross Domestic Product, Differentiated by Sectors (Million rupiah) Based on Constant Price in 1993

| Sectors | Years | | | |
|---|---|---|---|---|
| | 1999 | 2000 | 2001 | 2002* |
| Agriculture | 964,507 (41.1) | 1,033,815 (43.4) | 1,110,597 (44.3) | 1,187,259 (44.9) |
| Mining | 63,167 (2.8) | 63,691 (2.7) | 65,014 (2.6) | 66,472 (2.5) |
| Industry | 178,295 (7.8) | 182,098 (7.6) | 187,833 (7.5) | 194,457 (7.4) |
| Electricity | 18,908 (0.8) | 10,769 (0.5) | 20,801 (0.8) | 22,792 (0.9) |
| Building | 156,550 (6.8) | 160,246 (6.7) | 165,635 (6.6) | 172,911 (6.5) |
| Trading | 259,276 (11.3) | 266,994 (11.2) | 277,721 (11.1) | 290,293 (11.0) |
| Transportation and telecommunication | 202,830 (8.9) | 207,600 (8.7) | 215,568 (8.6) | 225,135 (8.5) |
| Financial services | 92,883 (4.1) | 93,682 (3.9) | 97,391 (3.9) | 104,848 (4.0) |
| Services | 350,864 (15.3) | 355,806 (14.9) | 366,902 (14.6) | 381,961 (14.5) |
| TOTAL | 2,287,380 | 2,383,700 | 2,507,463 | 2,643,128 |

Source: Central Sulawesi Province Statistic Agency 2005 (sulteng.bps.go.id/pdr2.htm).
Note: * = temporary data, Numbers in parentheses are percentages.

## 4.3 Land Use Conditions

Rice is the main staple food in the province and the total area planted with paddy in 2002 was 195,199.9 ha. This covers 121,796.8 ha (62.40%) of irrigated rice fields, 31,969.6 ha (16.38%) of non-irrigated fields and 41,433.5 ha (21.23%) that are temporarily non-cultivated. 26.9% and 15.2% of the irrigated rice paddy fields are located in Donggala and Poso. Both regions have roughly similar amounts of non-irrigated rice fields, around 20%. Temporarily non-cultivated rice fields are relatively higher in Poso (29.2%) than in to Donggala (7.2%). From this figure, it can be considered that Poso has the potential to increase its cultivation area for rice.

Table 4.3 shows non-paddy land use patterns in Central Sulawesi. Compared to other districts and municipalities, Donggala has the largest amount of upland (31.58%) and forestland (74.69%). Poso's land is 13.22% upland and 5.17% forestland**.**

Table 4.3 Size of Rice Area Cultivated, by District in Central Sulawesi Province 2002 (Ha)

| District | Size of rice field | | |
|---|---|---|---|
| | Irrigated | Non-irrigated | Temporary non-Cultivated |
| Banggai islands | 3410.0 | 904.0 | 536.0 |
| | (28.0) | (2.8) | (1.1) |
| Banggai | 19184.0 | 3665.3 | 1821.2 |
| | (15.8) | (11.5) | (3.6) |
| Morowali | 7127.2 | 6450.7 | 12908.3 |
| | (5.9) | (20.2) | (25.6) |
| Poso | 18535.8 | 6471.6 | 12082.3 |
| | (15.2) | (20.2) | (29.2) |
| Donggala | 32725.3 | 6152.0 | 2976.0 |
| | (26.9) | (19.2) | (7.2) |
| Toli-toli | 11725.0 | 2477.0 | 4946.0 |
| | (9.6) | (7.7) | (9.8) |
| Buol | 2366.0 | 3608.0 | 3285.9 |
| | (1.9) | (11.3) | (6.5) |
| Parigi-Moutong | 26413.5 | 2010.0 | 2318.8 |
| | (21.7) | (6.3) | (4.6) |
| Palu | 310.0 | 231.0 | 559.0 |
| | (0.3) | (0.7) | (1.1) |
| Total Central Sulawesi | 121796.8 | 31969.6 | 41433.5 |

Sources: Central Sulawesi Province Statistic Agency 2003 (BPS), own calculations.
Note : numbers in parentheses are percentages.

Table 4.4 Size of Different Non-paddy Land Use Areas, by District in Central Sulawesi Province 2002 (Ha)

| | Land use | | | | |
|---|---|---|---|---|---|
| District | upland | forest | settlement | Others | Non-cultivated |
| Banggai Islands | 101,279.6 | 44,915.5 | 2,669.1 | 24,563.8 | 120,636 |
| Banggai | 115,546 | 457,018.0 | 29,489.3 | 26,076.9 | 9,3754.5 |
| Morowali | 98,335.9 | 25,557.7 | 33,273.6 | 257,084.8 | 186,061.5 |
| Poso | 159,099.9 | 184,117.6 | 7,907.1 | 146,896.1 | 115,259.1 |
| Donggala | 380,084.6 | 2,662,289 | 17,459.8 | 138,755.2 | 153,496.3 |
| Toli-toli | 115,967.9 | 49,164.0 | 7,571.1 | 156,416.4 | 35,007.2 |
| Buol | 46,514.4 | 32,846.9 | 2,959.4 | 30,172.6 | 14,648.9 |
| Parigi-Moutong | 178,833.7 | 107,553.8 | 21,086.9 | 92,060.9 | 96,552.9 |
| Palu | 7,798 | 1,179.0 | 6,772 | 12,766.2 | 10,315.7 |
| Total Central Sulawesi | 1,203,460.0 | 3,564,641.5 | 129,188.3 | 884,792.9 | 825,732.1 |

Sources: Central Sulawesi Province Statistic Agency 2003 (BPS), own calculations.

## 4.5 Lore Lindu National Park

The Lore Lindu National Park is composed of valleys and mountains which stretch across 229,000 hectares. The park provides a habitat for more than 30% of the endemic birds and almost all of the endangered mammal and reptile species of Sulawesi.

Approximately 117 villages are located on the margin of the park and more 60 out of 117 villages are located close to the park from. In Donggala, the park covers three sub-districts: Palolo, Kulawi and Sigi Biromaru. In Poso, the park also covers three sub-districts: Lore Utara, Lore Tengah and Lore Selatan. The park is shown in Figure 4.1.

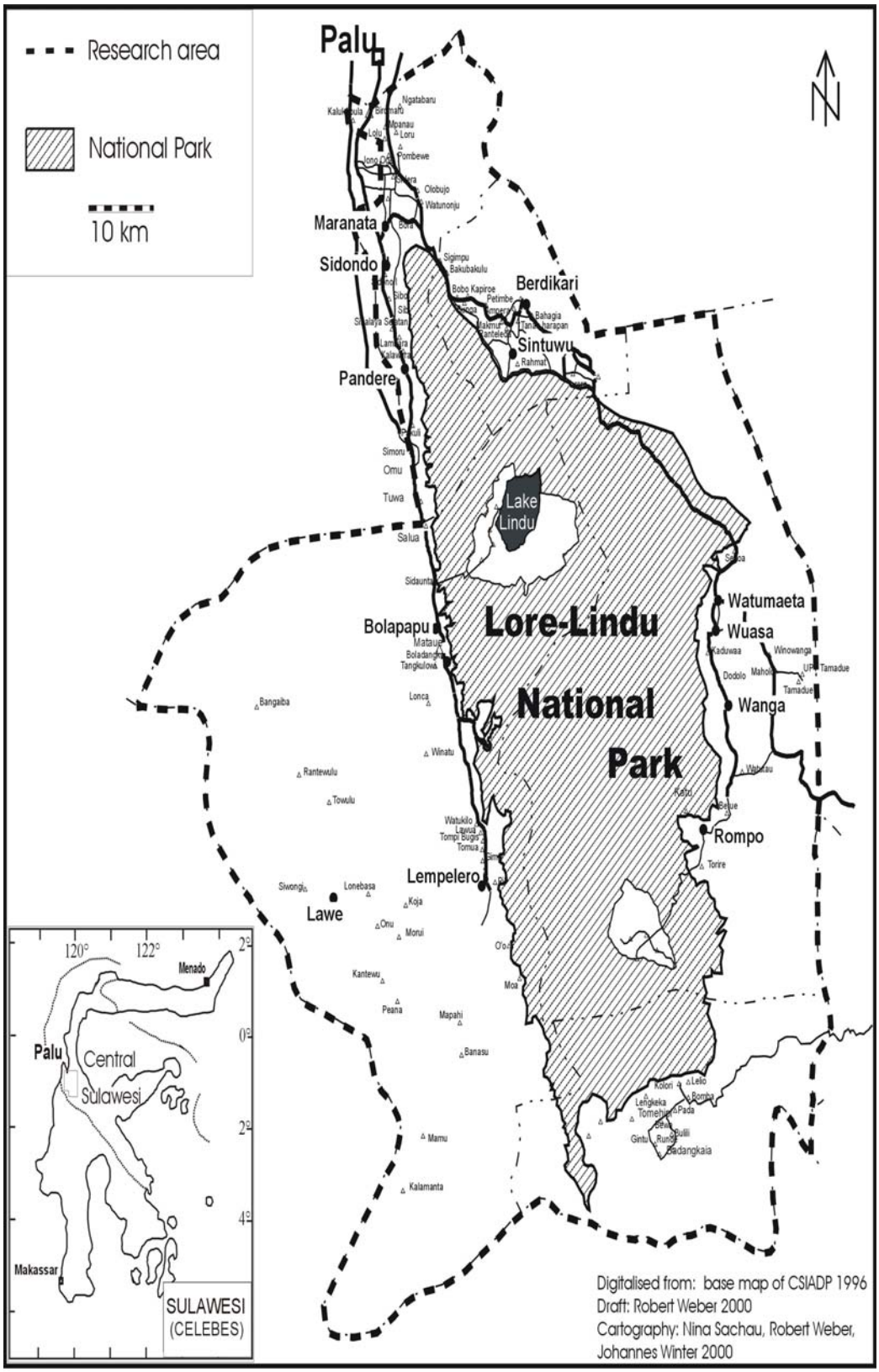



Figure 4.1 Map of Lore Lindu National Park and Research Area
Source : Weber (2000)

# 5 Access to Land and Land Tenure Security

## 5.1 Land Tenure and Land Use Change in the Lore Lindu Area

The land tenure system is considered to be one of the most important aspects of the farm economy since the main occupation of most households in the area is farming. Access to land in rural areas is an important input for the farmers' livelihood. Combined with other variables of input and asset variables, access to land helps rural households generate their income.

Land tenure in Central Sulawesi has fundamentally transformed since 1953, when land ownership was converted from the traditional form of ownership in which the land belonged to the kings to state ownership. Formerly the king of each region or swapraja, which represented each ethnicity in the province, had full access to and control over the land in his territory.

After the change in land ownership status, the state became an agent which had control over the land. This circumstance was then strengthened by a new regulation issued by the Central Sulawesi Governor in 1993 (Governor Decree no. 592.2/33/1993). It stated that the land in Central Sulawesi Province, which previously belonged to the swapraja, should be handed over to the state. After this regulation came into act, the process of land tenure started to change.

However, the transformation of land ownership was not beneficial for people who had inherited land from their ancestors which was inside a national park or even on the margin of the forest area. The new regulation prohibited those people from cultivating or even claiming their land, even though they actually had a right to it.

Different types of land acquisition are illustrated in figure 5.1. Three important sources of the households' access to land are heritage, purchase, and cleared primary forest.

The various processes of land acquisition can be summarized as follows:

In general, households that live in villages located at the forest margin have relatively greater access to the forested land. They begin land preparation for farming by clearing primary forest with the slash and burn method, which is then followed by shifting cultivation. Each new generation requires more land for their farming activities which leads to an expansion of this system over time. Because of some strict regulations from local governments, people experience difficulty when they try to clear the forest. In the case of the current generation, land is obtained through inheritance, particularly in lowland areas. Migrants often purchase land from local people.

Figure 5.1 Different Modes of the Households' Access to Land in Central Sulawesi

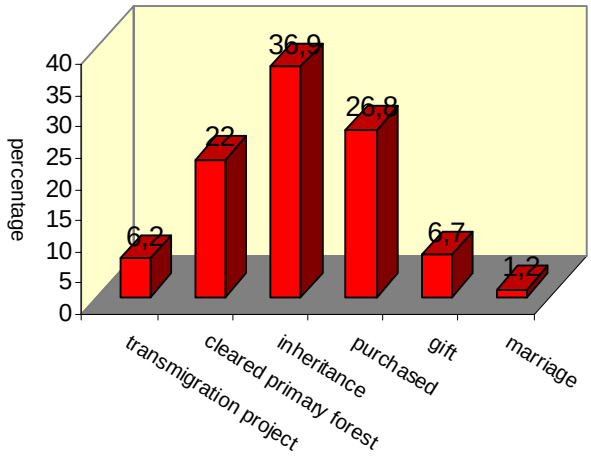



Table 5.1 gives an explanation of the different types of land acquired by different welfare status groups and ethnic groups. Comparing the three groups, the poorest and local ethnic households obtain farmland mostly by clearing primary forest; an average size is 7.9 ha. The situation is different respecting the highest welfare group and non-local ethnic group; they acquire land by purchasing it (with a high significance level).

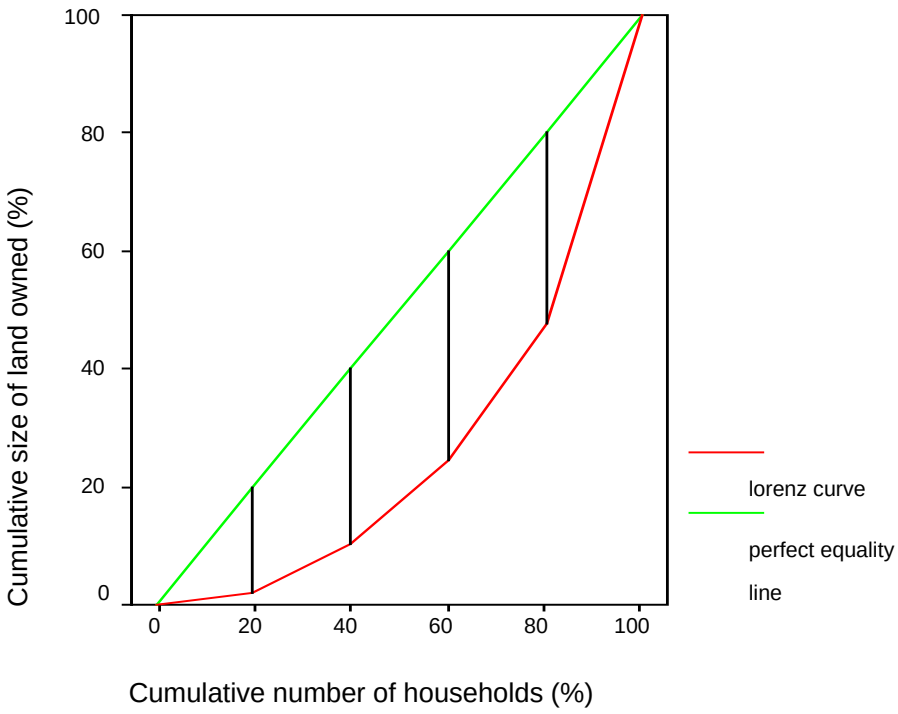
Table 5.1 Different Types of Land Acquired, by Poverty Groups and Ethnicity (mean land size in ha)

| Modes of land acquired | The poorest | | Poor | | Less poor | |
|---|---|---|---|---|---|---|
| | Local N=86 | Non-local N=10 | local N=86 | Non-local N=13 | local N=61 | Non-local N=37 |
| Transmigration | 0.5 | 0.0 | 0.5 | 0.0 | 3.1 | 0.4 |
| Cleared forest | 7.9 | 1.0 | 5.7 | 3.0 | 4.8 | 0.5 |
| Purchased | 0.4 | 13.6 | 2.2 | 12.3 | 6.1 | 18.1 |
| Heritage | 6.1 | 2.6 | 6.1 | 2.0 | 8.1 | 5.5 |
| Gift | 0.6 | 0.3 | 1.1 | 1.6 | 1.4 | 2.0 |
| Marriage | 0.4 | 0.0 | 0.0 | 0.6 | 0.0 | 0.1 |

On the average, each farm household in the research area controls more than 1.50 ha. However, some of the households are able to control much more land which creates even more disparities between different groups. This can be seen by calculating the Gini Index for land distribution. The Gini Index measures the difference between the actual distribution curve and the 45° line which represents absolute equality (Lorenz curve). The gap between the actual distribution curve and the equality line is a function of the degree of inequality. In an egalitarian society, the Gini would be 0.000, because the Lorenz curve would match the 45° line perfectly; a higher Gini Index means a greater distance between these curves and a more unequal distribution of land ownership.

The Gini Index for the research area is 0.46. This means that land distribution in the research area is still within the tolerable range if the Gini Index is lower than 0.5. However, in the long run some issues should be considered, particularly the large number of households encroaching into the forest and the fact that wealthier households accumulate their land by buying land from the poorest, which concentrates land ownership in the hands of a few households. The descriptive analysis shows that there are significant differences in the amount of land owned by different poverty groups (f-test significant at a 5 percent level).

Figure 5.2. Land Distribution among Households Sampled in the Research Area Using the Gini Index




The wealthier households accumulate their land by purchasing it from the households in the lower strata: for example, from the poorest households. For the poorest households, land holding is not merely an asset for agricultural practices but even more a form of social security which is directed toward alleviating the lack of capital to fulfil their basic needs. In some villages, it has been found that security is the only motivation of the poorest to control land over 2.00 ha. In case of a sudden health problem or educational expense, they can sell their land at a lower price than the normal market price for land (in some cases, it was found that households which faced liquidity problems sold 1 ha of their land for only 250,000 rupiah).

## 5.2 Land Tenure Security

In terms of the ethnicity of the land owners, the problem of land distribution has become more important recently. As depicted in Table 5.1 (in the previous sub section), the mode of land acquisition differs significantly between indigenous people (local people) and immigrants (non-local people). The process of land acquisition by immigrants has changed the land ownership structure in some villages in the forest margin area. The most important way for migrants in different livelihood strata to gain access to land is by purchasing it.

Unlike immigrants, the two important ways local people within different poverty groups gain access to land are by clearing primary forest and inheritance (allocated among family members).

The change of land ownership from local people to immigrants is considered one cause of the higher incidences of encroachment. Interviews with some immigrants yielded information on the process of land acquisition. The process of land occupation can be summarized as follows:

In the first years after arrival, immigrants work as tenants and in other sectors such as a trade. They establish their livelihood and accumulate assets and capital for at least five years after which they buy a piece of land and cultivate it with perennial crops such as coffee and cocoa. The village headman who represents the local government witnesses this process. In some cases, the process of land transactions are completed without a legal land transfer and land certificate. In terms of land security (particularly from the viewpoint of using the land as collateral) this has a negative impact if those households want to borrow money from a formal credit institution because the land cannot be used as collateral.

Table 5.2 presents a detailed picture of different modes of land acquisition concluded with different degrees of land ownership. The degree of land security can be seen from the different types of land registration. The highest degree of land security is achieved with the land ownership certificate which is issued by The National Agrarian Board (Badan Pertanahan Nasional). The lowest degree exists when the households have a right of use granted by the village headman. In that case, the time duration is very limited. More than 40 percent of the plots gained by different modes of land acquisition do not have a letter of land ownership. Even in the case of land transactions through purchase, only 20 percent of the plots were transferred with a land certificate. The fact that the number of registered plots were less than 80 percent leads to potential conflicts not only among the inhabitants but also between the inhabitants and the government.

The village headman has the authority to issue a letter of temporary land ownership after a land transaction. However, the letter issued by the village headman is not powerful enough to avoid potential land conflicts in the future. The households which have these letters cannot argue that the land belongs to them if someone has another letter of

certification registered by the government. Therefore, the process of land acquisition must be followed by formal land registration. The complexity of the land registration process and the lack of awareness of the importance of land registration are two reasons why many households do not have a land certificate. As a result, the number of households that register their land, according to the head of BPN District Donggala, makes up less than 20 percent of the households which hold land certificates.

Table 5.2 Number of Plots, by Type of Letter of Land Ownership

| Mode of land Acquired | Letter of land ownership (number of plots) | | | | No title | Total number of plot |
|---|---|---|---|---|---|---|
| | Certificate | LT[a] | LVH[b] | Others | | |
| Transmigration | 13 (19.7) | 4 (6.1) | 9 (13.6) | 11 (16.7) | 29 (43.9) | 66 (100) |
| Cleared forest | 12 (6.8) | - | 14 (6.8) | 5 (2.4) | 175 (85) | 206(100) |
| Inheritance | 61 (16.7) | 4 (1.1) | 33 (9.1) | 25 (6.9) | 241 (66.2) | 364 (100) |
| Purchase | 58 (22.0) | 30 (11.4) | 34 (12.9) | 14 (5.3) | 128 (48.7) | 263 (100) |
| Gift | 10 (15.1) | - | 5 (7.6) | 4 (6.1) | 47 (71.2) | 66 (100) |
| Marriage | 3 (27.3) | - | - | - | 8 (72.7) | 11(100) |

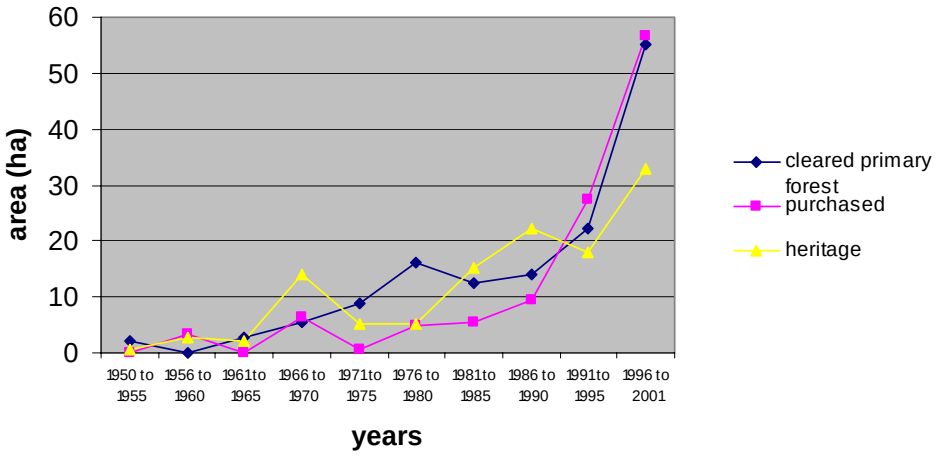
Note : numbers in parentheses are percentages
[a] = letter of land transaction
[b] = letter from village headman

To increase the number of transactions concluded with a land certificate, the government created a subsidized land certification programme (PRONA). At the regional level, it is decided which villages will obtain a land certification programme while considering budget limitations. Due to the process of the village selection, land registration is not spread among all villagers within one village or even all among villages in one district. Nevertheless, the cost of land registration through PRONA is cheaper than the normal procedure conducted by households which are willing to register their land. The cost for getting land certified without any subsidy from the government is over 1,000,000 rupiah compared to 250,000 rupiah per plot through PRONA.

Different types of land acquired by households in the upland areas and from 1951 to 2000 are depicted in figure 5.3. The findings are the results of the responses to the question that they were asked as to how they had acquired their plots. In the last fifteen years, dry land acquisition through purchase, either completed with a title or in an informal land market transaction, increased tremendously. Meanwhile, the amount of cleared primary forest in the same period followed the same pattern of land purchase activity. Both of the

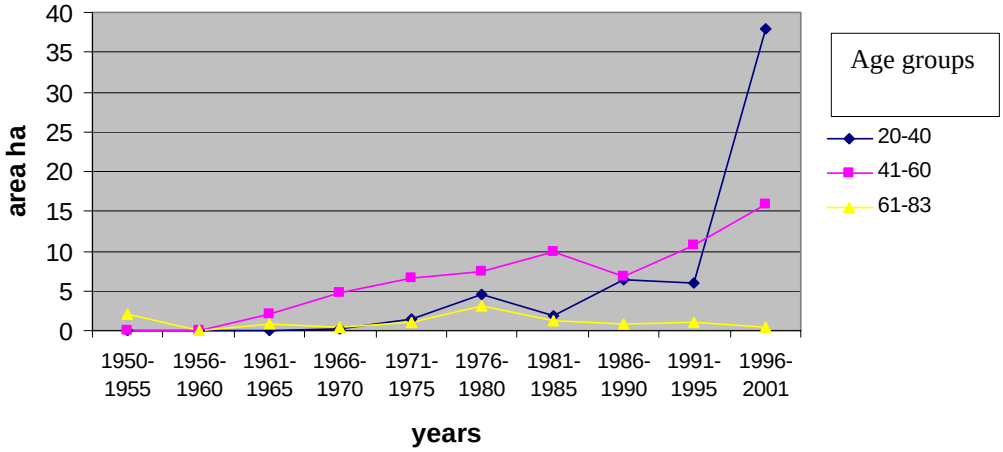
processes of dry land acquisition imply that the amount of single-family ownership and private ownership increased.

Figure 5.3 Type of Acquisition of Upland from 1950-2001



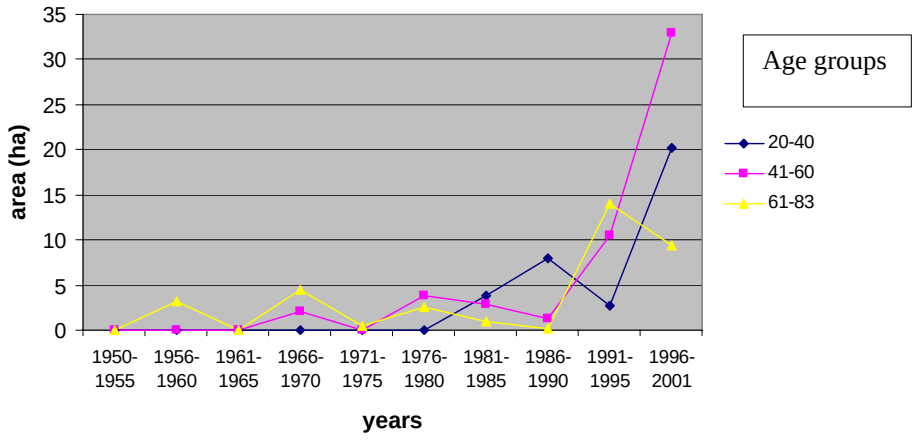

The pattern of land acquired in Figure 5.4 does not consider the effect of different age groups of the heads of the households. As (Deaton 1997) suggested, to avoid the different effects of different ages of the heads of the households on the time series data, cohort effects should be considered. Figure 5.4 depicts a pattern of land acquisition after considering cohort effects. The age of the heads of the households was divided into three groups: (1) 20 - 40 years old, (2) 41- 60 years old, and (3) 61 - 83 years old.

Figure 5.4 Acquisition of Upland Clearing Primary Forest from 1950 to 2001, Differentiated by Age Groups




The three age groups expose different trends concerning land acquired by clearing primary forest. The trend of the third group was relatively constant throughout the years. The second group exposes an increasing trend in this activity. The head of the households that belong to this group can be categorized as of productive age and strong enough to carry out this activity. The increasing trend is more pronounced in the youngest age group. In the last ten years, this group accumulated land up to 38 ha.

Figure 5.5 Purchasing of Upland from 1950 to 2001,Differentiated by Age Groups




Besides being of a productive age, the second group has frequently achieved a better livelihood. The figure shows that the trend to acquire land by purchasing increased remarkably in this group. Although not so much as among the second group, the trend in

the first group increased slightly. The third group shows a different phenomenon; starting in the 1950´s the trend fluctuated and in the last ten years seems to have decreased.

A traditional system found in the research area is that parents bequeath their own land to the extended family. The figure 5.6 shows this circumstance. The first group exhibits an increasing trend. The inheritance process in the second group fluctuated during the years and remained relatively constant in the third group.

Figure 5.6 Inheritance of Upland from 1950 to 2001,Differentiated by Age Groups

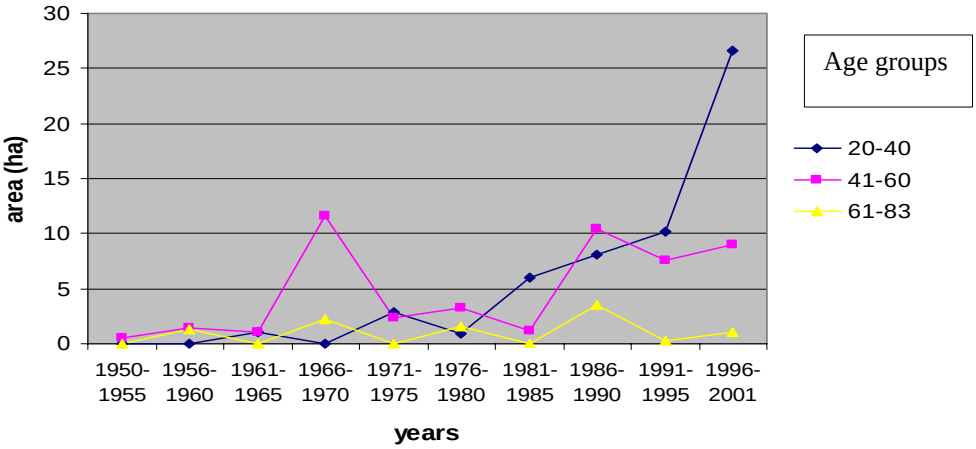


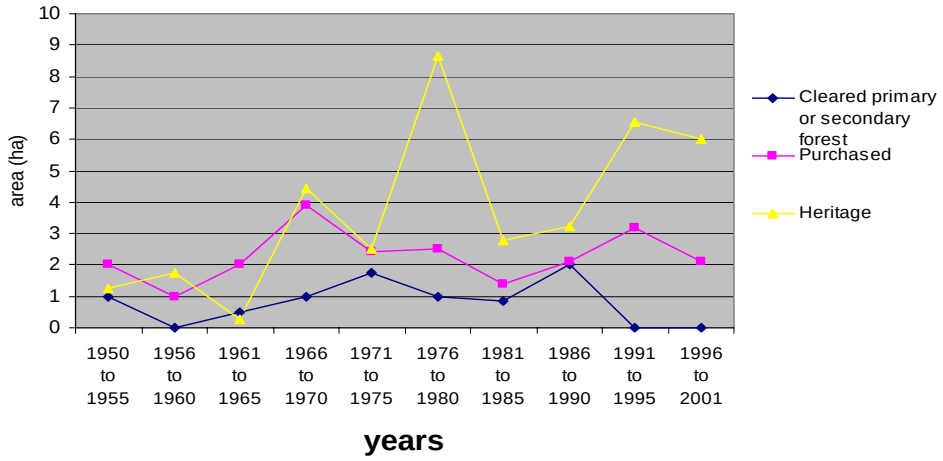

Table 5.3 gives information concerning different modes of land acquisition in the dry land area differentiated by poverty and ethnic groups.

Table 5.3 Different Modes of Land Acquisition in the Upland Area According to Different Poverty Groups and Ethnicity

| Modes of Land Acquisitions | The poorest | | Poor | | Less poor | |
|---|---|---|---|---|---|---|
| | local N=86 | non-local N=10 | local N=86 | non-local N=13 | local N=61 | non-local N=37 |
| Cleared forest | 7.4 | 1.0 | 4.8 | 2.8 | 4.3 | 0.5 |
| Purchased | 0.3 | 11.5 | 1.2 | 9.0 | 3.6 | 15.1 |
| Inheritance | 5.3 | 1.2 | 3.9 | 0.0 | 3.4 | 4.8 |
| Gift | 0.4 | 1.5 | 0.8 | 1.5 | 0.9 | 1.7 |

Figure 5.4 shows different types of land acquisition in the lowland area, particularly devoted to paddy from 1951 to 2001. In contrast to the case of dry land, the common mode of land acquisition in rice paddy plots is through inheritance. A rice paddy field is an important asset in rural societies due to its role in maintaining a certain level of food security. Local values also reinforce the prohibition of selling paddy fields. As a consequence, the farmers must bequeath this land to their immediate family (son/daughter). The effect of different age groups on the lowland acquisition can be seen in the appendix (Figures 1, 2, and 3).

Figure 5.7 Types of Land Acquisition for Paddy Fields (lowland) from 1950-2001




## 5.3 Land Use Systems and Tenure Security

Table 5.4 provides detailed information at the plot level about different types of land use, differentiated by the way the households acquired the land and the degree of land security with which the transaction was completed. The degree of land security is represented by the different types of legal documents.

The first mode of land acquisition is clearing primary forest. The type of land which is often acquired by clearing primary forest is dry land and is cultivated with various perennial crops such as coffee or cocoa. Almost 87 percent of the plots acquired by this process are acquired without any letter of land transfer. These plots seem to be insecure because they potentially lead to conflicts. Certain rules are followed in order to reduce the conflicts among the villagers. After clearing primary or secondary forest, they put certain trees along the boundary as an indication that the plot belongs to someone (information from a personal interview with some households). As also reported by (Burkard 2002), conflicts among villagers are rare in the case of permanently cultivated plots acquired through clearing forest. However, this situation is still insecure whenever the government inquires about the legal status of the land. The government can argue that the mode of land acquisition was illegal and not register the land in the BPN. Moreover, if these plots are located inside the Lore Lindu National Park, the villagers have very little bargaining power with which to try to keep their plots. The government

has another interest in encouraging the villagers to register their land: to obtain revenue from land tax. Only 8 percent of these plots have an accompanying letter from a village headmen. As explained previously, the village headman has the authority to issue a letter of land transfer, but it is very temporary.

In general, land acquisition through clearing primary/secondary forest is completed without a land title.

The second mode of land acquisition is inheritance, which contrary expectations to shows more variety in the types of land titles. For example, in the case of paddy fields (SW) the percent of plots which had a certificate was 10 percent, 8 percent had a letter of transfer from the village headman, and 9 percent had other types of land titles.

32 percent of the homestead plots which are acquired through inheritance had a land certificate, and 49 percent did not have any form of legal land transfer. 63 percent of the plots located in the low-land region cultivated with paddy and 76 percent of the plots in the dry land cropped with perennials crops were acquired without a land title. This lack of land security is hypothesized to lead to a low level of incentives to invest in the long run in such measures as soil such soil conservation.

The land security situation is better when the land is transferred through purchase. With respect to homesteads, lowland, and dry land, the percentage of plots which had a land certificate are 44, 8, and 17 percent, respectively. However, even in the case of the process of land transfer through purchase, many plots are purchased without any legal land transfer. Most of these are dry land plots with 50 percent of the plot transactions in this category completed without a land certificate.

Table 5.4 Distribution of Plots Differentiated by Mode of Land Acquisition, Type of Land, and Type of Land Title.

| | Modes of land Acquisition | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cleared forest | | | | | | Inheritance | | | | | | Purchase | | | | | |
| | C | LT | LVH | O | NLT | Tot | C | LT | LVH | O | NLT | Tot | C | LT | LVH | O | NLT | Tot |
| HS | 2 (12) | - | - | - | 15(88) | 17 (100) | 29(32) | 1(1) | 13(14) | 4(4) | 45(49) | 92 (100) | 28(44) | 5(8) | 3(5) | 3(5) | 25(39) | 64 (100) |
| SW | 2 (33) | - | - | 3(50) | 1(17) | 6 (100) | 10(14) | - | 8(11) | 9(12) | 47(63) | 74 (100) | 3(8) | 5(13) | 6(15) | 4(10) | 21(54) | 39 (100) |
| DL | 6 (4) | - | 14 (8) | 2 (1) | 142(87) | 164 (100) | 18(10) | 3(2) | 11(6) | 10(6) | 132(76) | 174 (100) | 22(17) | 18(14) | 22(17) | 5(4) | 66(50) | 133 (100) |
| FG | 2 (28) | - | - | 2(28) | 3 (44) | 7 (100) | 1(50) | - | - | - | 1(50) | 2 (100) | - | - | - | - | - | - |
| Nag | - | | | | 8(100) | 8 (100) | 3(15) | - | 1 (5) | 1 (5) | 15 (75) | 20 (100) | 5(19) | 2(7) | 2(7) | 2(7) | 16(60) | 27 (100) |

Notes : C = transaction completed with land certificate,
LT = completed with letter of land transaction,
LVH = completed with letter from village headman
O = other type of land title,
NLT = transaction completed without land title.
Numbers in parentheses are percentages of the total plots.
HS= Homestead, SW= Paddy field, DL= Dry land, NAg= Non-Agricultural Land, FR= Forest land

## 5.4 Determinants of Land Possession

The model used to determine the process of land acquisitions follows Otsuka and Quisumbing (2001). This model explains a trend in the type of land acquisition in the research area. The main hypotheses are :

1. If land is not scarce, the common mode of acquisition is through clearing forest, followed by inheritance. As land becomes scarce, the process of land acquisition operates through a land market: selling and buying activities.
2. There is a link between poverty and deforestation as can be seen by equation 5.1.

The formal Tobit model for this analysis is:

Forest land acquired by smallholders

$$= a_0 + a_1 \text{ (Vector of exogenous variables)} + a_2 \text{ (sub-district dummy)} + e_1 \quad (5.1)$$

Transfer of family land or inheritance

$$= b_0 + b_1 \text{ (Vector of exogenous variables)} + b_2 \text{ (sub-district dummy)} + \gamma \text{ (forest land acquired by smallholders)}, + e_{2.} \quad (5.2)$$

Purchased land

$$= c_1 + c_2 \text{ (Vector of exogenous variables)} + c_2 \text{ (sub-district dummy)} + \delta_1 \text{ (forest land acquired by smallholders)}, + \delta_2 \text{ (transfer of family land)} + e_{2.} \quad (5.3)$$

### 5.4.1 Forest land Acquisition and Issue of Poverty

The issues of forest encroachment and its agents are still being debated (Tole 1998). One of the important factors related to forest encroachment is agricultural expansion because of the commercialization of agricultural products. The relative importance of crop income in the research area as reported by (Schwarze 2004) is 44 percent of the total household income, with 56 percent generated from perennial and 44 percent from annual crops. Cocoa is considered an important perennial crop. This means that the higher income from crop activities dominated by cocoa encourages households to increase their land possession for agricultural practices by clearing forest. Cocoa is booming in the research area where smallholders have attempted to enlarge their land to cultivate cocoa trees since 1990. Moreover, the farmers´ share of this product as reported by Anggraenie was, 84 percent FOB (Free on Board) from Central Sulawesi in 2004. The attractiveness of cocoa trees attracts people from outside Central Sulawesi to cultivate it as well as local people.

Table 5.5 presents descriptive statistics variables used in the Tobit model. The total number of households that were included in the household sample for the analysis of land acquisition was 283 households. All of these households owned land. Households which had no land were excluded from the analysis.

Table 5.5 Means and Standard Deviation of Socio-economic Characteristics, Variables in Tobit Model

| Variable | Means | Standard deviation |
|---|---|---|
| ***Dependent variable*** | | |
| Size of land acquisition from the forest | 54.28 | 125.73 |
| Size of family land | 77.52 | 113.58 |
| Size of purchase land | 54.98 | 132.13 |
| ***Independent variable*** | | |
| **A. Human capital and Socio-economic Characteristics** | | |
| Age of head of household (years) | 44.07 | 14.13 |
| Education of head of household (years) | 3.86 | 1.86 |
| Number of adults | 3.74 | 1.71 |
| Migration of head of household (0= non-migrant, 1=migrant) | 0.51 | 0.500 |
| Ethnicity of head of household (0=local people, 1= non-local) | 0.21 | 0.41 |
| Index of Social Capital | 210,60 | 261,76 |
| **B. Accessibility** | | |
| Distance house – road (minutes) | 0.92 | 2.71 |
| **C. Welfare status** | | |
| Poverty index | 0.02 | 1.00 |
| Number of observations | 283 | |

Table 5.6. Determinants of Land Possession at the Household Level: Tobit Regression

| Variables | Forest land (cleared forest) | | Family land[a] | | Purchased | |
|---|---|---|---|---|---|---|
| | Coefficient | t- value | Coefficient | t- value | Coefficient | T value |
| Constant | -352.30 | -2.82*** | 32.68 | 0.47 | -147.69 | -2.11** |
| Forest land | - | - | -0.61 | -3.46*** | -0.133 | -1.17 |
| Family land | - | - | - | - | -0.43 | -3.30*** |
| Age of head of household | 0.92 | 0.51 | -0.61 | -0.87 | 2.13 | 2.00** |
| Education of head of household | -3.91 | -0.27 | -3.15 | -0.57 | -16.75 | -2.00** |
| Number of adults | 14.36 | 0.97 | -0.51 | -0.09 | 1.57 | 0.17 |
| Migrant status of head of household | 24.81 | 0.50 | -52.03 | -2.58* | 3.35 | 0.10 |
| Ethnicity | - 219.81 | -2.87*** | -39.20 | -1.47 | 152.00 | 3.97*** |
| Distance home-road | 12.10 | 1.62* | 8.34 | 2.45** | 7.45 | 1.24 |
| Index of social capital | 0.17 | 1.84* | 0.15 | 3.98*** | 0.41 | 0.68 |
| Poverty index | -51.74 | -1.80* | 23.68 | 2.27** | 70.13 | 4.27*** |
| Dummy sub-district Lore Utara | 56.19 | 0.86 | 119.96 | 5.00*** | 112.87 | 2.87*** |
| Dummy sub-district Palolo | 177.22 | 2.20** | 44.52 | 1.40 | 43.34 | 0.94 |
| Dummy sub-district Kulawi | 160.31 | 2.46*** | 73.68 | 2.83*** | 32.54 | 0.77 |
| Chi-square | 48.80 | | 80.08 | | 91.10 | |
| p-value | 0.000 | | 0.000 | | 0.000 | |
| Pseudo R square | 0.04 | | 0.03 | | 0.05 | |
| Number of observations | 283 | | 283 | | 283 | |

Notes: Family land includes inheritance, gifts, and land acquired by marriage
***, ** and * are significant at 1, 5, and 10 percent levels respectively

The results in Table 5.6 show that forest land acquisition by smallholders is significantly influenced by household ethnicity, distance to road, social capital, poverty index (as a proxy for different welfare situations), and the dummy variable sub-district Palolo. The other variables have the expected signs although they turned out to be statistically insignificant such as age of head of household, education of head of household, number of adults. The explanation of each independent variable follows:

As was hypothesized, there is a close relationship between poverty and processes of deforestation in our research area. Furthermore, the empirical results of the Tobit analysis confirm that poverty is an important variable in determining forest land acquisition. The negative sign and high significance level of this variable explains that the wealthier households (indicated by a higher poverty index) tend to acquire land from cleared primary forest less frequently than other groups. In contrast, (Godoy, *et al.* 1997)) found that the wealthier households contribute significantly to deforestation in Honduras. The higher the income of rural households, the more they cleared primary forest.

The household ethnicity dummy variable also had a negative sign, implying that the local people are more likely to possess land acquired through clearing primary forest than immigrants. As was pointed out in the preceding sub-section, the poorest are mostly local people. This finding is similar to (Chomitz 1999) who found that there is close relationship between poverty and deforestation and that the poorest groups are local or indigenous people who lack opportunities elsewhere in the economy. It can be explained that local people who live in the margin area of the forest and far away from a main road depend solely on forestland. This result was supported by the positive sign of the distance variable. Households which live far from the main road indicated that they settled in the forest margin area to have a better access to land from the forest for their agricultural activities. This geographical aspect of the household is considered important for the deforestation processes.

The fact that the dummy variable sub-district Palolo is statistically significant means that the incidence of households with land from cleared primary forest is higher compared to other villages. The location of the sub-district Palolo is at the border of a forest (the Lore Lindu National Park) with a population density of 75.8 people/km$^2$ and is, according to (Van Rheenen, *et al.* 2003), the second largest densely populated sub-district in the forest

margin area. As one of the destinations for the immigrants looking for land, the forest pressure through agricultural activities in this sub-district is very high. Moreover, Maertens (2002) explained that one third of the total area is used for agriculture in this sub-district, while in the others sub-districts this figure is less than 10 percent.

The index of social capital has a positive sign and a 10 percent level of significance. A higher number in the social capital index leads the households to increase land ownership by clearing the forest. In this case, social capital plays an important role in the households' access to the forestland. Social capital refers to the households access to social networks and institutions. When local people interact through the same local organizations, their good relationships and networking supports the activity of clearing the forest.

Sub-district Kulawi -located on the border of Lore Lindu National Park - as well as sub-district Palolo have a positive sign and high significant coefficients showing that land was acquired by clearing forest in this sub-district.

### 5.4.2 Family Land Acquisition

The next column (third and fourth) in table 5.6 explains the estimated results for the acquisition of family land which includes inheritance, gifts, and land acquired through marriage. Six out of twelve variables in this model are statistically significant. A detailed explanation of each variable follows:

Forest land acquisition has a negative impact on family land holding which suggests that households with a larger forest land holding decrease the amount of land allocated or given to the extended family.

The ethnicity of the head of the household has a significant negative effect on family land holding. This means that local people tend to bequeath their land to the extended family. This finding is supported by other variables; the dummy variables sub-district Lore Utara and Kulawi have a positive sign and are statistically significant. Compared to other districts, the social values in those sub-districts are stronger, and villagers still act according to their social customs.

That the family land holding is influenced by its welfare status can be seen from the positive sign of the poverty index with a 5 percent significant level. The wealthier households tend to bequeath their land to their immediate/extended family. This reflects the function of land as an effective instrument to transfer wealth to the next generation.

The social capital index influences family land holding since family land consists of inherited land, land given as a gift, and land acquired through marriage. It is not transferred as a gift if the parties do not have a good relationship beforehand. Therefore, the role of social capital has a positive effect on the land accumulation in this category.

### 5.4.3 Land Acquisition through Purchase

The last two columns explain the determinants of land acquisition by purchasing. Family land has negative sign with high significance as does forest land, but insignificantly. Both variables suggest that it is likely that a household will try to find another mode of land acquisition (e.g., purchase) when traditional land transfers either from ancestors or cleared forest, do not suffice. It strengthens the postulate that when land grows scarcer a process of land transactions is activated. This finding is similar to those of (Otsuka and Quisumbing 2001) in Ghana.

Contrary to the determinants of land forest acquisition, the variables poverty and ethnicity have a positive sign and are significant at the 1 percent level of significance. This can be explained by the fact that wealthier households and non-local/migrant people increase their land accumulation through purchase from others households. One of the motives for migrants to come to this area is to seek land, and in one village, Watumaeta, the ratio between migrant and local people is one to one (1:1), based on a personal interview with the village headman. Therefore, compared to other sub-districts, the incidence of households accumulating land by buying from others households is significant in the sub-district Lore Utara, to which Watumaeta belongs.

The older the head of the household, the more likely it is that one can increase land holdings through purchase. This can be seen by the positive sign of this coefficient which is significant at the 5 percent level. Probably this occurrence is in line with the ability to maintain their livelihood and accumulate other assets.

# 6 Rural Financial Markets and Borrowers Behaviour

In rural areas, there are typically two types of credit institutions: formal and informal. An example of three different types of formal credit institutions are: (a) the Bank Rakyat Indonesia Unit Desa (BRI-UD), which is located in every sub-district or Kecamatan; b) government credit programmes such as KUT (Kredit usaha tani), which is particularly focused on supporting agricultural activities to achieve and maintain a certain level of food security; and c) microfinance institutions (MFI) such as cooperatives, and private rural banking (Bank Perkreditan Rakyat, BPR). Informal credit institutions exist as a complement to the formal institutions. The most important informal credit institutions can be grouped into categories: merchant/trader, pure moneylender, and relatives. This section presents with detailed information of each type of formal and informal credit institutions operating in the research area.

## 6.1 Formal Credit Market

This section describes the different formal institutions in the rural areas which emphasizes on the analyses of the performances of different institutions particularly the BRI-UD in each sub-district. The different sectors which are financed by the BRI-UD are explained in order to compare their performance.

### 6.1.1 Bank Rakyat Indonesia-Unit Desa (BRI-UD)

The Bank Rakyat Indonesia-Unit Desa (BRI-UD) is an important formal credit institution which has been widely established in rural areas in Indonesia. This institution is internationally recognized as an example of a successful microfinance institution running a rural finance business. (Chaves and Vega 1996; Robinson 2001) report that the BRI-UD is the largest financially self-sufficient provider of sustainable microfinance. (Zeller and Meyer 2002b) emphasized that the success story of the BRI-UD is due to the innovative programmes offered to reduce cost and risk and target the poor. The goal of reducing cost and risk can be achieved through placing the bank close to the potential clients. The BRI-UD is located in almost every sub-district capital (Kecamatan). As with other unit businesses, before constructing the office and its services, some considerations should be taken into account by the head quarters of the BRI such as the potential number of clients and small businesses that already exist in the region. Therefore, the success of the establishment of the BRI-UD depends on various small business activities which take advantage of the BRI-UD services.

Some peculiarities of the BRI-UD are mentioned as follows:

- Products

The Bank Rakyat Indonesia as a microbanking system offers innovative loan products such as the Kredit Umum Pedesaan (KUPEDES), the most supreme programme which is provided to selected individual clients. The aim of this programme is to develop and improve small businesses and enterprises. The size of KUPEDES loans varies from Rp 25,000 to 50 million rupiah, with a nominal flat monthly interest rate of 1.5 percent on the original loan balance for most loans. This interest rate charge, even unsubsidized, does not seriously affect the repayment capacity of the borrowers. Demand for loans greater than 50 million rupiah is handled by the branch of the BRI which is located in the district or province.

The key conceptual development of KUPEDES considers several aspects: simplicity, transparency, accessibility, not being subsidized, cost recovery, profitability, and sustainability (BRI 2001).

- Type of KUPEDES

Essentially, KUPEDES offers two types of loans: (a) working capital and (b) investment loans. Working capital loans are assigned to the entrepreneur and to individuals with a permanent monthly income such as civil servants. The purpose of this loan is to provide additional capital to either fulfil and accomplish the needs for working capital or finance consumption such as buying transportation vehicles. The economic sectors that can be financed are:

1. Agriculture: This category pertains to all activities carried out by small enterprises and retailers/wholesalers concerned with supporting agricultural farm activities by selling inputs (e.g, fertilizer, pesticide, seeds) or trading agricultural products.
2. Industry: All small-scale industries concerned with processing raw material.
3. Trade: Loans are used to finance trading activities related to the fulfilment of basic needs.
4. Services: Loans are used to finance businesses related to public services such as workshops or tailors.
5. Individuals with a permanent income: Loans are used for consumption and production activities with repayment fees based on the income of the borrowers.

Investment loans are given to small-scale businesses to finance their business infrastructure or production equipment. For the permanent income target groups, this loan is directed to finance their needs either for consumption (such as buying transportation vehicles or production activities). Economic sectors that have a possibility of acquiring these loans that are similar to working capital loans are as follows:

1. Agriculture: Loans are used to finance agricultural equipment such rice milling units, tractors, and other permanent equipment.
2. Industry: Loans are used to finance the procurement of small-scale industry materials.
3. Trade: Loans are used to finance small-scale enterprises in activities such as purchasing equipment or improving warehouses.
4. Service: Loans are used to finance the purchasing of workshop equipment or transportation vehicles.
5. Individual with a permanent income: Loans are for consumption and production activities with repayment fees based on the income of the borrowers.

- Collateral

In the formal credit markets, one of the conditions that must be fulfilled is that the borrower has to put down collateral before signing the contract. Types of collateral that the BRI-UD demand from the borrowers can be classified into two types: (a) moveable materials such as transportation vehicles complete with the legal aspects of an official letter, machinery, equipment, or jewellery; and (b) immobile materials such as legally titled land or buildings.

### 6.1.2 The BRI-UD in the Research Area

The objective of this sub-chapter is to give an overview of credit expansion performance in different economic sectors intermediated by the BRI-UD. In the research area, each sub-district has a BRI-UD with a different year of inception. The existence of the BRI-UD in the sub-district Lore Utara is relatively new compared to other sub-districts. It was established in 2003, preceded by the sub-district Palolo, which was established in 2001. Meanwhile the BRI-UD in the sub-districts Kulawi and Sigi-Biromaru have been established for a long time. The following analyses only considers three BRI-UDs. Lore Utara was excluded because of unavailability of data.

#### 6.1.2.1 The BRI-UD Kulawi

Figure 6.1 depicts time series data concerning the total loan standing for different types of KUPEDES in the sub-district Kulawi. The BRI-UD in the sub-district Kulawi is located in Bolapapu which is the capital city of the sub-district. The group financed most by BRI-UDs is the permanent income group. Some advantages in financing this group can be explained as follows:

The BRI-UDs do not need to spend time and effort in pressing for debt payments. Every month the BRI-UDs withdraw the obligatory repayment from the bank account or pay check. This procedure has the advantage of not only reducing risk but also reducing transaction costs and also enforces the contract. Compared to other sectors, the loan standing trend in this sector has increased surprisingly in the last few years. In 1997 it was 537 million rupiah and in 2003 2.5 billion rupiah, which is a 4.6 times increase during the seven-year time span.

The second and third most important sectors are trade and agriculture. Interestingly, the loan standing of the agriculture sector has increased significantly since 2000, compared to the period before. This occurred due to the important role of cocoa. Moreover, since the beginning of the economic crisis in 1997, which led to a devaluation of the Indonesian currency, agricultural products such cocoa, which is one of the important agricultural export products, have enjoyed 'windfall profits.' Indeed, many households are interested in doing business in cocoa. The loan standing of the agriculture sector in 2000 was 122 million rupiah. It increased almost six times by 2003 to become 725 million rupiah.

Figure 6.1 Outstanding Loans from 1997-2003 in the BRI-UD Kulawi, Differentiated by Economic Sectors

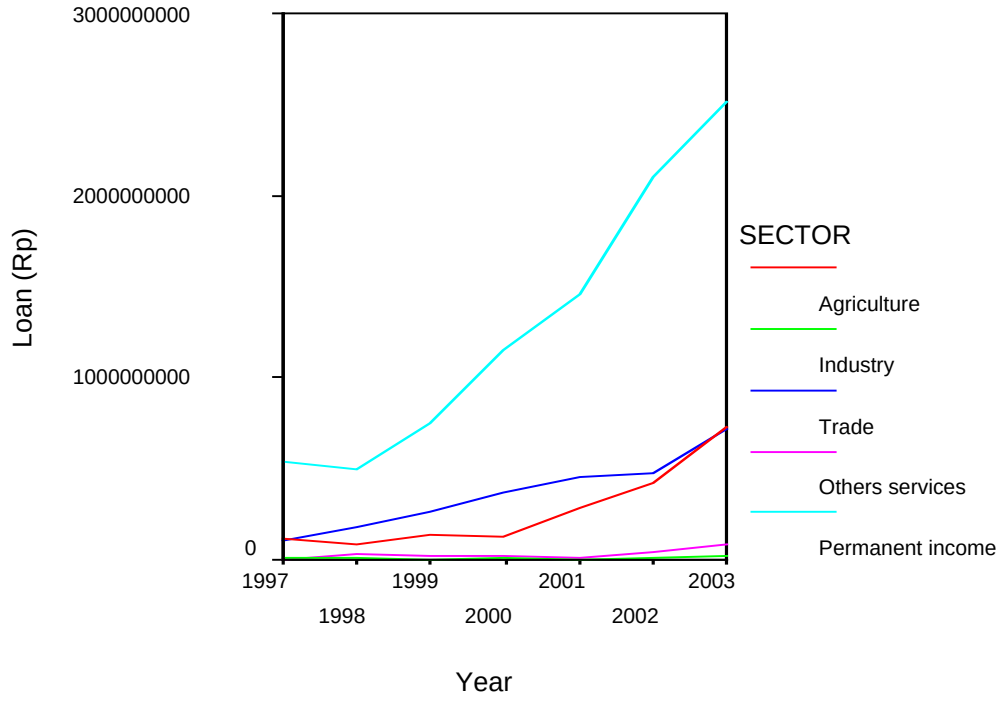
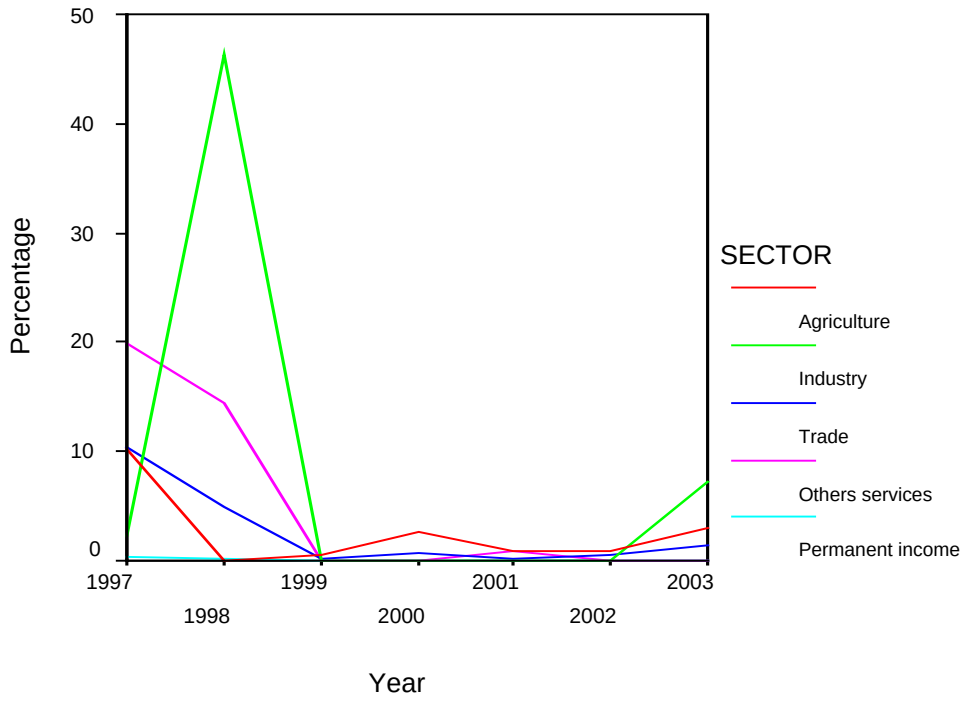



Figure 6.2 presents the ratio of total delinquent payments to total loan standing from different economic sectors. As pointed out previously, the relatively less risky target groups that are financed by the BRI-UD are the permanent income groups.

Figure 6.2 shows that compared to other sectors the percentage of delinquent payments was relatively small and stable from 1997-2003, less than 1 percent. The ratio in the industrial sector increased remarkably. In 1997 this value was only 2.3 percent; one year

later in 1998, it became 42 percent. Other sectors showed a different pattern during the same period. The economic crises faced by all the regions in Indonesia had a great impact on the performance of the industrial sector, not only in urban areas but also in rural areas such as Kulawi.

Figure 6.2 Ratio of Delinquent Payment to Total Outstanding Loans from 1997-2003 in the BRI-UD Kulawi (Percentage), Differentiated by Economic Sector

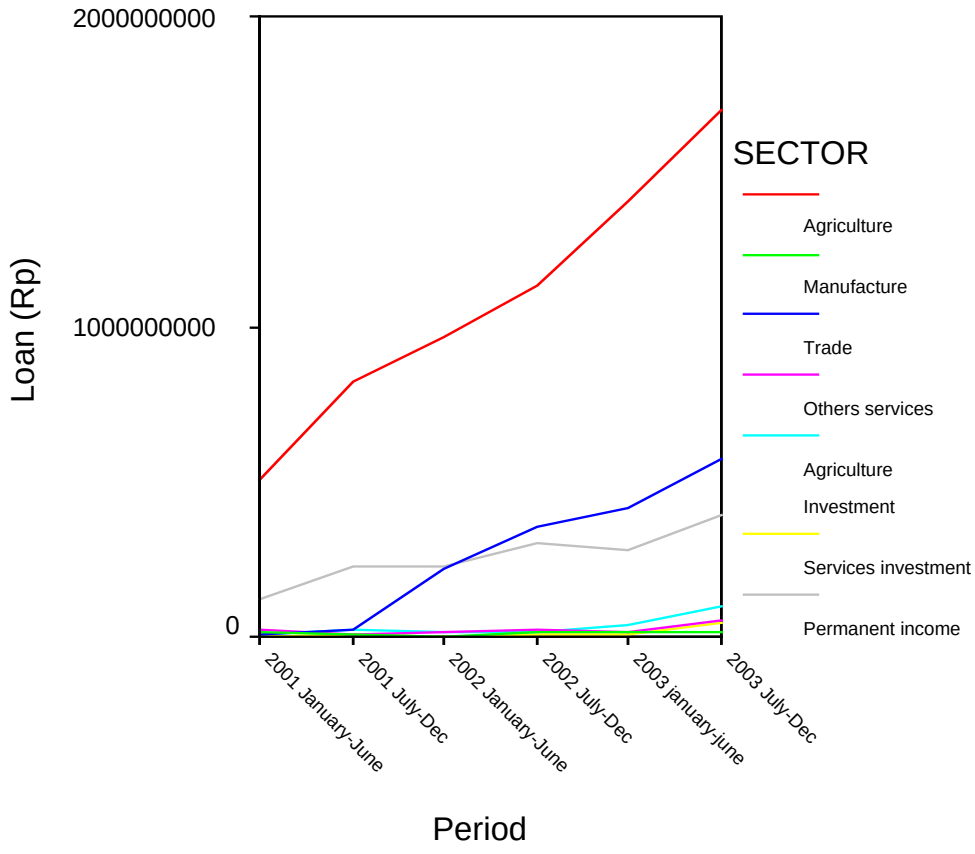



For the agricultural sector, this ratio still falls within a tolerable range with less than 3 percent delinquent payments in 1999. Since 1999, the percentage of delinquent payments in the agricultural sector increased more than in other sectors. This occurred for two reasons. First, some government credit programmes which are intermediated by the BRI-UDs faced problems which led the borrowers to demand that their debt be written off. Another explanation is that the decreasing price of cocoa compared to two years before led some cocoa farmers to try to reschedule their debt (personal communication with the head of the BRI-UD Kulawi).

### 6.1.2.2 The BRI-UD Palolo

Compared to other institutions, the existence of the BRI-UD in the sub-district Palolo is relatively new; it was established in 2001. Agriculture is one of the most attractive economic sectors and has the potential for a high rate of economic growth in this region. Moreover, Palolo has become an production centre in Central Sulawesi Province due to its advantage in producing cocoa and paddy.

Figure 6.3 Outstanding Loans from 2001-2003 in the BRI-UD Palolo, Differentiated by Economic Sectors

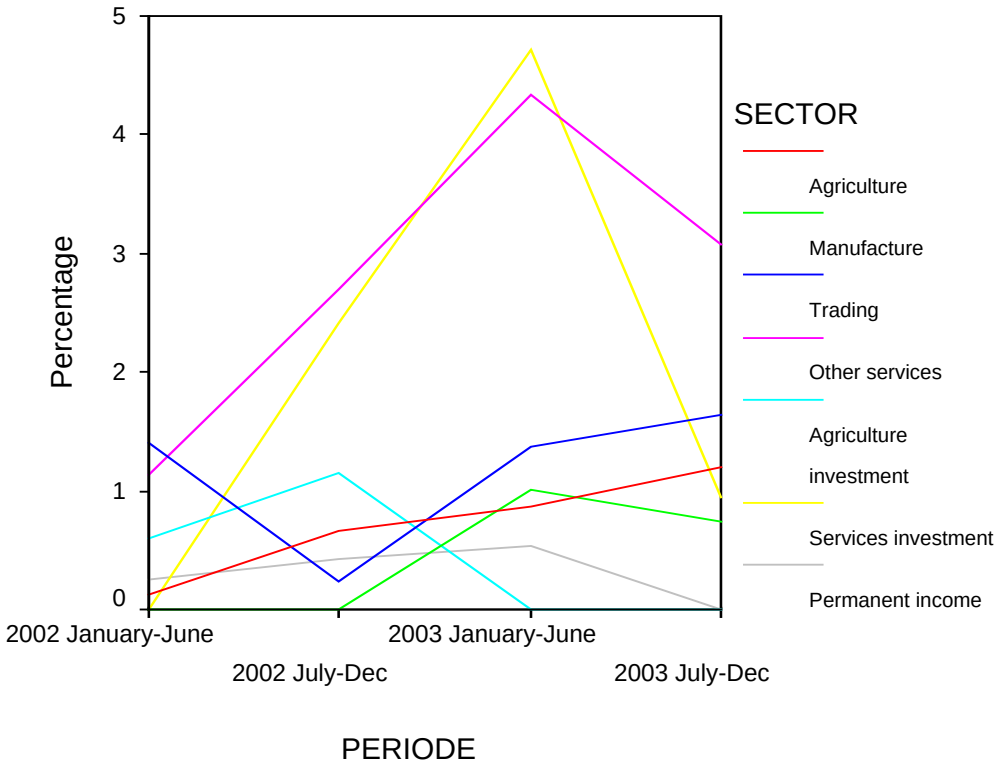



The reason for the establishment of the BRI-UD in the sub-district Palolo was to finance agricultural activities. Figure 6.3 shows the amount of standing loans in Palolo. Since the BRI-UD was launched in Palolo, the agricultural sector has absorbed a large amount of capital compared to others sectors. In 2001, the total loan standing in the agriculture sector was 502 million rupiah; extraordinarily, it increased 3.5 times to become 1.7

billion rupiah in only 2.5 years. It seems that credit expansion in the agriculture sector is preferred to that in others sectors. The head of the BRI-UD explained that this phenomenon occurred due to the driving force of the booming cocoa market and the increasing need of farmers to extend their agriculture activities for both perennial and annual crops.

The performance of credit expansion that was delivered to the agriculture sector can be seen from the ratio of delinquent payments to total standing loans as depicted in Figure 6.4.

Figure 6.4 Ratio of Delinquent Payment to Total Outstanding Loans from 2002-2003 in the BRI-UD Palolo (Percentage), Differentiated by Economic Sector



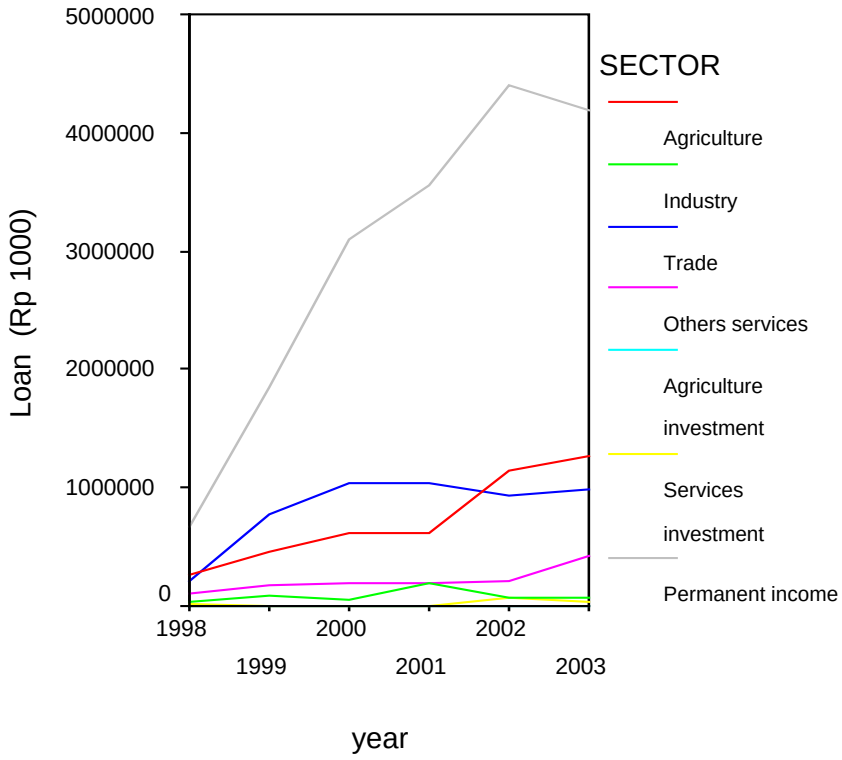

Compared to others economic sectors, this ratio is lower, even if there is an increasing pattern. In 2002 the ratio was 0.13 percent; this increased 9 times to become 1.2 percent in 2003. It appears to be the case that in these periods (not only in the sub-district Palolo but also in Kulawi) the expansion of credit to the agriculture sector was not followed by a lower ratio between debt and loan standing. However, this does not indicate that investments in the agriculture sector are riskier. This is supported by the explanation of

the head of the BRI-UD in Palolo. He explained that the willingness of farmers to engage in credit schemes is high even in the case of loans which are provided by the BRI-UD and are not subsidized by government,. The problems arise because the farmers (as potential clients) do not know the appropriate procedure as well as due to a lack of administrative documents such as a lack of collateral.

### 6.1.2.3 The BRI-UD Sigi Biromaru

Figure 6.5 shows the total loan standing by different economic sectors in the BRI-UD Sigi Biromaru between 1998 and 2003. The pattern of credit expansion in the BRI-UD Sigi Biromaru is similar to that of the BRI-UD Kulawi where the amount borrowed by permanent income clients rose tremendously from 668 million rupiah in 1998 to 3.1 billion rupiah in 2000. In 2000, the next most important sector was the trade sector, followed by agricultural. However, in 2002 credit expansion in agriculture surpassed the amount borrowed by the trade sectors.

Figure 6.5 Outstanding Loans Differentiated by Economic Sectors from 1998-2003 in the BRI-UD Sigi Biromaru



Due to a lack of data on the amount of debt, the performance of each sector based on the ratio between debt and total loan standing could not be analysed further.

After looking at the credit expansion provided by the different BRI-UDs, it is clear that the BRI-UDs prefer in general to finance less riskier sectors; in this case it is the permanent income groups. Some facts show that such loans can be utilized not only for productive activities but also solely for consumption. From a lender point of view, as long as one sector is more profitable and the risk of default is lower, then this sector will be chosen. The permanent income clients are more secure as they can provide routine monthly repayments. The type of collateral that this group can offer is a monthly income statement and an official letter from the institutions where the borrower works. The BRI keeps such letters as collateral and repayment is automatically withdrawn from the borrower's bank account. The case of the BRI-UD Palolo seems to be interesting since the agricultural sector in that area is profitable and, therefore, there is no doubt that the BRI-UD is willing to finance the agricultural sector as well as other sectors.

### 6.1.3 Government Credit Programmes and Micro Finance Institutions

The agricultural credit programme Kredit Usahatani (KUT) is one of various government credit programmes which has been implemented in the research area. The purpose behind this credit scheme is to increase the available working capital for the farmers in order to improve their agricultural activities and mainly to maintain a certain level of food security which is targeted by the government. KUT Credit schemes are based on the capacity of the farmers' groups. The programmes do not require collateral and impose 'social collateral' based on joint liability through group lending. Farmers' groups in certain areas have the opportunity to apply for a certain amount of working capital, based on their needs which must to be described in detail. With the assistance of extension services, farmers' groups submit this application to the village cooperative unit (Koperasi Unit Desa/KUD). All documents are then submitted to the BRI. In this case, the BRI functions as a channel institution which delivers the subsidized loans as soon as all documents have been approved.

The lengthy procedure and processes potentially lead to misuse of these programmes. Many researchers have found that the percentage of failure was higher than that of achievement (Taryoto et al.1992, Smeru 2004). The KUTs in the research area, particularly in the district Donggala had a very low repayment rate (see appendices

Figure A.4.) In some cases farmers asked to write off their debt due to harvest failure. Others asked to have their debt written off due to bad experiences (many farmers who had received this programme several years ago succeeded in demanding that their debt be written off) and problems with the KUT programmes.

Microfinance institutions provide other sources of formal credit. Various microfinance institutions exist in the research area and service borrowers' needs with different credit schemes such as the Bank Perkreditan Rakyat (BPR), a cooperative. Due to a lack of data about microfinance institutions, no further description of these institutions will be made.

### 6.1.4 Borrowing Behaviour in the Formal Credit Markets

After having created a general picture of different types of formal credit institutions, this section will provide an overview of formal credit markets based on the household survey. 44 households participated in the formal credit markets and 54 percent of them were the BRI-UD clients. The average amount of money borrowed from the BRI-UDs by households is 5,340,000 rupiah, which is higher than the amount borrowed from others institutions. Although the BRI-UDs offer the possibility of lending a minimum amount of money up to 25,000 rupiah, household data showed that there were no households which wanted to borrow minimum loans. The minimum amount of money which the households borrowed from the BRI-UD was 1,000,000 rupiah. Because of the costs of monitoring and fees, the clients prefer not to borrow and the BRI-UDs prefer not to lend smaller amounts. Therefore, the amount of money borrowed was rarely below 100,000 rupiah.

Table 6.1 Average Amount Borrowed at Household Level, Additional Cost, and Waiting Time According to Different Formal Credit Institutions

| Formal institution | Average amount borrowed (Rp) | Period of loans (years) | Additional cost[a] (percentage) | Waiting time[b] (days) |
|---|---|---|---|---|
| BRI | 5,340,000 | 2.6 | 2.7 | 16.8 |
| Government programmes | 815,312 | 1.00 | 5.1 | 143.4 |
| MFI | 2,164,286 | 1.0 | 2.8 | 11.9 |
| Average (N=44) | 3,479,660 | 1.6 | 3.4 | 54.6 |

Notes :[a] percentage of additional cost spent by households (fee, transportation, other expenditures) to total amount borrowed

[b] difference in days between application and loan receipt.

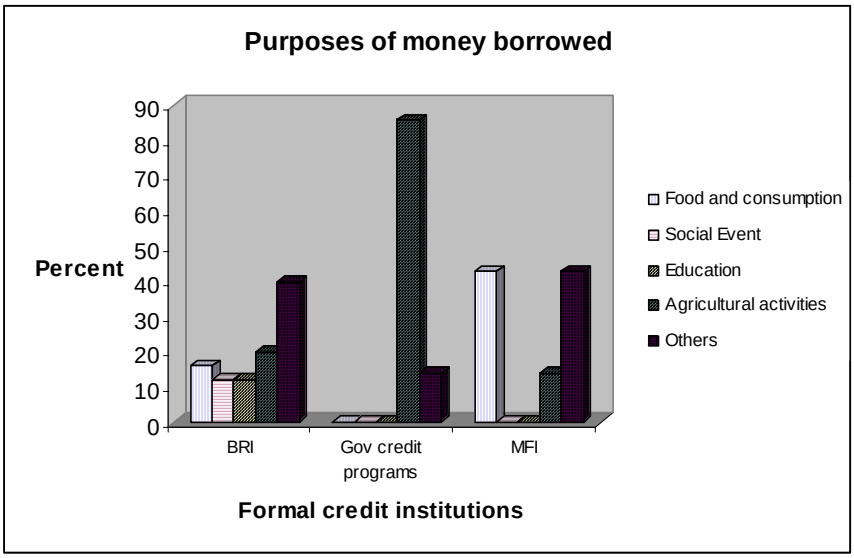
One of the characteristics of the formal credit markets is that the loans are long term loans. The third column in table 6.1 shows the loan period, the time from the borrower's receipt of the loan until the end of the repayment period. The average loan period in the formal credit markets is 1.6 years; the BRI-UD has the longest loan period (2.6 years).

It is interesting to note the client's waiting time, (the time from when the borrower submits all application documents until the loan is approved). The government credit programmes take almost 144 days (4.8 months), a lengthy procedure presumably caused by the many institutions involved in these programmes. Some households involved in this credit programme stated that this credit programme did not deliver on time and sometimes could not be used to finance their agricultural activities as proposed. As a consequence, the performance of government credit programmes is affected and the repayment rate results were very low.

Additional costs in the formal credit markets are varied across different institutions and include fees and transportations cost. The higher percentage of additional costs that households spend in government credit programmes is around 5.1 percent of the total money borrowed.

The different purposes for borrowing money from the formal institutions can be seen in figure 6.6. It is clear that most loans from the government credit programmes borrowed by more than 80 percent of the households were used to improve their agricultural activities. However, there were also some discrepancies about the purpose of the credit programmes. 10 percent of the households that borrowed loans from credit programmes did not spend these loans for agricultural activities. This was because the loan was not delivered on time.

Figure 6.6 Purpose for Borrowing Money from the Formal Credit Markets




The purposes for borrowing money from the BRI-UDs are more varied; 20 percent of the households utilized these loans for enhancing their agricultural activities, while more than 40 percent of the households spent the loans for others activities such as renovating a house or buying transportation vehicles.

## 6.2 Informal Credit Market

The existence of informal credit markets in the rural areas is important in order to provide financial services. This section explains the role of informal credit markets, agents of informal lenders, and the interlink between informal credit and other agricultural input and output markets.

### 6.2.1 Types and Occupation of the Informal Lenders

The term informal credit market refers to all financial transactions and loans occurring outside the regulation of a central monetary or financial market authority (Adams and Fitchett 1992). As pointed out in the preface of this chapter, common sources for informal credit transactions are shopkeepers, traders, and relatives. Shopkeepers and traders act as moneylenders. The coverage area of an informal money lender is localized, and the lender often has a highly personal relationship with the client. A close relationship between the informal lender and borrowers is one reason they make a loan

transaction. The informal lender has enough information about the clients' activities to reduce potential default. Table 6.2 provides information on the types of informal lenders and their relationships with the borrowers.

Table 6.2 Distribution of Occupations of Informal Lenders and the Relationship between the Informal Lender and Borrower (Percentage)

| Relationship | Occupation | | | | | |
|---|---|---|---|---|---|---|
| | Shopkeeper | Land owner | Trader | Civil servant | Farmer | Others |
| | N = 48 | N = 1 | N = 19 | N = 16 | N = 76 | N = 8 |
| Family | 4.2 | | 15.8 | 43.7 | 47.4 | 37.5 |
| Friend | 18.7 | | 10.5 | | 13.1 | |
| Other relative | 20.8 | | | 12.5 | 22.4 | |
| Neighbour | 12.5 | | 26.3 | 12.5 | 15.8 | 12.5 |
| Friend from other organisation | 2.1 | | | 18.8 | | 37.5 |
| Other | 41.7 | 100 | 47.4 | 12.5 | 1.3 | 12.5 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

More than 50 percent of the households which borrowed money from an informal lender declared that one of the reasons they borrowed from these institutions was a personal relationship. These finding are consistent with empirical results obtained in several developing countries, including the Ivory Coast, rural Thailand (Azam, *et al.* 2001).

In the informal credit markets, loans are typically granted for only a short period and are not secured by collateral. The ability to extend their loans to clients is limited and the loan transaction procedure is very simple.

### 6.2.2 Purpose for Borrowing Money

Table 6.3 gives information about the purpose for borrowing money from informal lenders. The table shows that the most important activities were related to fulfilling basic needs. Except in the cases when the lender was a trader or civil servant, more than 40 percent of the borrowing households used the loan for food and consumption. The percentage of the borrowers who put their borrowed money into investment activities was less than 16 percent. If the lender was a trader, 47.4 percent of the borrowers used the loan for agricultural activities.

Table 6.3 Purpose for Borrowing Money from Different Types of Informal Lenders

| Purpose | Lenders | | | | | |
|---|---|---|---|---|---|---|
| | Shopkeeper | Land owner | Trader | Civil servant | Farmer | Others |
| | N = 48 | N = 1 | N = 19 | N = 16 | N = 76 | N = 8 |
| Food and consumption | 58.3 | 100 | 36.8 | 18.8 | 48.7 | 62.5 |
| Health | 8.3 | | 5.3 | 12.5 | 13.2 | 12.5 |
| Social event | 4.2 | | 5.3 | 6.3 | 2.6 | |
| Education | 2.1 | | | 31.3 | 5.3 | 12.5 |
| Agricultural activities | 12.5 | | 47.4 | 12.5 | 15.8 | 12.5 |
| Others | 14.6 | | 5.3 | 18.8 | 14.5 | |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

A look at the different purposes for borrowing money from informal credit markets confirms that the households which borrow from these institutions have often suffered an economic crisis. Therefore, the existence of these institutions is necessary, particularly in the rural areas in which there is a great deal of poverty incidence.

### 6.2.3 Amount of Money Borrowed and Procedure

Table 6.4 shows the performance of the different types of informal lenders according to the average amount borrowed, period of loan, additional costs, and waiting time. The average amount of money borrowed from informal lenders is 221,964 rupiah. Compared to others types of informal lenders, shopkeepers are able to provide more loans, up to 2 million rupiah. Although loans are provided from their own funds, some shopkeepers extend their ability to increase capital by borrowing from their counterparts, formal institutions (banks). In contrast, the farmer as an informal lender could only provide up to 100,000 rupiah because of the limitation their own funds.

From the evidence in the research area, the motivation for farmers to offer some loans was solely due to social and personal relationships. They expect that at some point the situation will be reversed, and if they need some money due to an unpredicted crisis, they expect reciprocity.

As typical of informal credit markets, the time period for loans is short; table 6.4 shows that the average time period is 2.3 months. This means that the borrower should repay the

debt within a 2.3 month time span. As mentioned previously, short term loans mainly fulfil basic needs.

Table 6.4 Average Amount Borrowed, Additional Costs, and Waiting Time for Different Informal Credit Institutions

| Informal institution | Average amount borrowed (Rp) | Period of loans (months) | Additional cost[a] (percentage) | Waiting time[b] (days) |
|---|---|---|---|---|
| Shopkeeper | 404,833 | 2.75 | 0.2 | 0.8 |
| Trader | 300,000 | 2.21 | 1.3 | 1.0 |
| Land owner | 218,473 | 5 | 0.6 | 0.9 |
| Civil servant | 336,875 | 2.69 | 1.9 | 0.7 |
| Farmer | 89,565 | 2.03 | 0.5 | 1.0 |
| Others | 151,250 | 1.38 | 0.5 | 0.1 |
| Average | 221964 | 2.3 | 0.5 | 0.9 |

Notes :[a] additional costs spent by households ( fee, transportation, others expenditure) as percentage of total amount borrowed
[b] number of days between application and receipt of loan.

The simple procedure for the contractual arrangements in the informal credit markets can be seen in the last column of table 6.4. The informal lenders deliver credit efficiently: the transaction costs are lower and the loan is provided on a timely basis. The average waiting time to receive a loan is 0.9 days. This means that one day after asking for a loan from an informal lender, it will be approved and delivered.

Testing loans, a term introduced by (Ray 1998), are common. Based on personal interviews with some informal lenders (shopkeepers and traders), the testing loan and procedure to get a loan can be explained as follows. A small loan is given with some considerations of the ability to repay it. These small loans serve as an indirect test of the borrower's intrinsic honesty. If they repay these small loans, then the probability of receiving another loan is greater.

The informal lenders observe the clients capability by investigating the potential harvest of their agricultural products. The expected harvest is used to determine the amount of money lent. The clients are not able to borrow more than the value of the expected

harvests. The lenders document these kinds of activities and they have a good record for each client. During the harvesting period, the lenders directly survey their clients' fields. The borrowers are obligated to sell their products to the lender. In case of potential opportunistic behaviour, where borrowers try to sell their product to others traders, the lender can easily detect this. The lenders use local information as an enforcement mechanism and this is a key component of the procedure of offering loans. This only works if the number of clients is limited. If a borrower successfully repays the first testing loans, then the lenders are willing to provide another loan in the future.

Nevertheless, a household that borrows from an informal lender is still faced with some additional costs, including transportation costs, and the cost of buying cigarettes that are consumed together with the lender. However, these costs are relatively low compared to the total amount borrowed. The average additional cost is 0.5 percent of the total amount borrowed, or 1,100 rupiah.

### 6.2.4 Interlinkage with Other Markets

In congruence with the findings of many studies, there are links between credit, the inputs, and the outputs of agricultural markets and especially the credit which is provided by shopkeepers or traders. In the research area, shopkeepers or traders provide loans with certain arrangements. The business activity of providing loans is a part of the total business that they conduct.

Table 6.5 Frequency of Different Obligations Demanded by the Informal Lender

| Obligation | Lenders | | | | | |
|---|---|---|---|---|---|---|
| | Shopkeeper N = 48 | Land owner N = 1 | Trader N = 19 | Civil servant N = 16 | Farmer N = 76 | Others N = 8 |
| Less wages | 4.2 | | | | 1.3 | 1.8 |
| Sell harvest | 52.1 | 100 | 57.9 | | 6.6 | 12.5 |
| Buy something | 8.3 | | | | | 3.0 |
| Higher interest rate | 9 | | 5.3 | | 3.9 | 1.8 |
| Something else | 8.3 | | 21.1 | 18.8 | 3.9 | 8.9 |
| Do nothing | 27.1 | | 15.8 | 81.3 | 84.2 | 75.0 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

Table 6.5 displays the types of obligations faced by borrowers with different types of informal lenders. It explains the links between informal credit markets and other markets.

The percentage of shopkeepers' and traders' clients that have the obligation to sell their harvest at a lower price than the market price for certain agricultural commodities are 52.1 and 57 percent respectively. Therefore, shopkeepers and traders prefer to lend to clients from whom they also purchase agricultural goods. This evidence brings us to the situation where the terms of transaction in one market depend on the terms and conditions in the other. (Anggraenie 2005) reports that in the research area rice and cocoa traders who also run their business as shopkeepers in addition to lending money charge lower prices for both products.

Surprisingly, not all credit transactions are accompanied by obligations, even when the lenders are shopkeepers or traders. The percentage of transactions with no particular obligations where borrowers received a loan from shopkeepers and traders are 27.1 and 15.8 percent respectively. This occurred even more often when the occupation of the informal lender was a civil servant or farmer. The average amount of money borrowed without any obligations is less than 125,000 rupiah. Loans for more than this amount are generally accompanied by certain obligations.

## 6.3 Explaining the Distribution of Formal and Informal Credit in Rural Areas

This sup-chapter provides information on the different target groups of formal and informal credit markets based on the different indicators such as location, farm size, and welfare situation of the households. The concept of credit limit is used in order to analyse the households' access to formal and informal credit markets.

### 6.3.1 Distribution by Sub-district

Tables 6.6 and 6.7 present the distribution of the households that have access to and participate in the informal or formal credit markets.

The distribution of households engaged in formal credit market activities varies across the sub-districts. The percentage of households with access to formal credit markets is high in the sub-district Lore Utara (33%), and followed by sub-district Sigi Biromaru (25%). The same pattern was found reflecting the percentage of households which participate in formal credit markets. In sub-districts Lore Utara and Sigi Biromaru, the percentage of households that borrowed from formal credit markets are 24 percent and 18 percent respectively. The sub-district Lore Utara represents pure rural areas in which the

activities are dominated by agriculture. The sub-district Sigi-Biromaru is a more rural-urban sub-district because it is located in the periphery of the city of Palu (capital city of Central Sulawesi Province). Interestingly, there are no sample households that borrowed from formal credit markets in the sub-district Palolo.

In contrast to the distribution of sample households participating in formal credit markets, more than 50 percent of the households have access to the informal institutions across the sub-district. The highest percentage is in the sub-district Palolo with 82 percent. This differs greatly from the participation in the formal credit market in which only 4 percent of households participate. It seems that the sample households in the sub-district Palolo rely more on the informal institutions. This is verified by the fact that 45 percent of the households borrowed from the informal institutions. In Palolo there are many informal institutions, and each has certain clients. Most of the informal lenders in this area are shopkeepers.

The highest percentage of sample households participating in the informal credit markets is in the sub-district Sigi-Biromaru, with 92 percent.

Tabel 6.6 Distribution of the Households' Access to and Participation in Credit Market, by Sub-district

| | Sub-district | | | |
|---|---|---|---|---|
| | Lore Utara | Palolo | Sigi-Biromaru | Kulawi |
| Total household | 80 | 45 | 92 | 76 |
| Formal credit | percentage of total sample households in sub-district | | | |
| a. access | 33 | 4 | 24 | 17*** |
| b. participating | 24 | 0 | 18 | 10*** |
| Informal credit | percentage to total sample households in sub-district | | | |
| a. access | 60 | 82 | 79 | 71*** |
| b. participating | 80 | 45 | 92 | 76* |

*** and * are significant at 1 and 10 percent levels respectively

The average formal credit limit for the sample households in different sub-districts is depicted in Table 6.7. The highest average formal credit limit is attained in the sub-district Lore Utara with 2,162,812 rupiah. In the same area, the average informal credit

limit is only 180,687. One could note that except in Palolo, the average formal credit limit is higher than the informal credit limit. The ratio between the average credit limit and average amount borrowed uncovers the phenomenon that in the formal credit markets more than 50 percent of the available credit is used, which is close to the credit limit. In contrast, in the informal credit markets, the gap between the credit limit and amount of money borrowed was less than 50 percent, except in the sub district Lore Utara, where it was almost 73 percent.

In general the respondents who did not ask for loans could nevertheless borrow some amount from both sectors. This can be explained by the positive credit limit as in Palolo.

Table 6.7 Average Credit Limit and Amount Borrowed, by Sub-district in Central Sulawesi.

| Sub-district | Credit limit (Rp) | | Amount borrowed (Rp) | |
|---|---|---|---|---|
| | Formal | Informal | Formal | Informal |
| Lore Utara | 2,162,812 | 180,687 | 1,228,075 | 130,937 |
| Palolo | 44,444 | 711,555 | 0 | 152,911 |
| Sigi Biromaru | 560,199 | 161,521 | 344,764 | 59,695 |
| Kulawi | 739,868 | 158,210 | 398,684 | 86,447 |

note: credit limit and amount borrowed from formal institution are significant at 1 percent level (anova analyses).

### 6.3.2 Distribution of Borrowers by Farm Size

Table 6.8 gives by farm size an overview of the distribution of households with access to and that participate in both formal and informal credit markets. The land owned, represented by the farm size, is perceived as one of the important determinants of access to credit. A household with a large cultivated area may be considered as potential clients by formal institutions because with respect to the economics of scale their agricultural activities are sufficient and probability bankruptcy is low. The percentage of the households with access to formal credit is likely to be positively correlated with farm size, except for the farm size 1.51-2.5 ha. Formal institutions prefer to lend money to the households with larger sized farms. This can be seen by the fact that 30 percent of the

households with farms larger than 2.5 ha have access to credit, which is relatively high compared to other groups.

The percentage the households participating in formal credit markets does not share this pattern. The different between households with access to and participation for each category of farm size confirms that not all households with access to formal credit decide to borrow money. Only 2 percent the households in the 0-0.50 farm size group did not participate. Indeed, most of the households with access to formal credit institutions did participate.

The pattern of access to informal institutions is different from that of formal institutions. The percentage of households with access to informal credit is similar for all sizes of farms, except for the group > 2.50 ha. This indicates that for informal credit markets land is not an important determinant of access.

Tabel 6.8 Distribution of the Households' Access to and Participation in Credit Markets, by Farm Size

| | Area of land cultivated (Ha.) | | | | |
|---|---|---|---|---|---|
| | 0-0.50 | 0.51-1 | 1.01-1.51 | 1.51-2.50 | > 2.50 |
| Total households | 58 | 59 | 59 | 60 | 57 |
| Formal credit | percentage of total households | | | | |
| a. access | 14 | 20 | 29 | 15 | 30* |
| b. participating | 12 | 12 | 24 | 10 | 17 |
| Informal credit | percentage of total households | | | | |
| a. access | 76 | 75 | 75 | 75 | 61 |
| b. participating | 45 | 52 | 39 | 37 | 35 |

* significant at 10 percent level

Table 6.9 depicts by the farm size the credit limit and amount borrowed from formal and informal credit markets. The highest average formal credit limit for groups with farm size > 2.50 ha. is 1,732,807 rupiah. However, the average amount borrowed is 939,596 rupiah. Hence, there are unused credit lines of almost 45 percent. This is related to the ability of this group to finance themselves, either for working capital or consumption purposes.

Table 6.9 Average Credit Limit and Amount Borrowed, by Size of Area Cultivated in Central Sulawesi.

| Farm size (Ha.) | Credit limit (Rp) | | Amount borrowed (Rp) | |
|---|---|---|---|---|
| | Formal | Informal | Formal | Informal |
| 0-0.51 | 427,586 | 126,448 | 295,603 | 96,741 |
| 0.51-1.00 | 349,661 | 107,288 | 213,288 | 64,949 |
| 1.01-1.51 | 1,587,006 | 150,423 | 754,548 | 66,694 |
| 1.51-2.50 | 749,333 | 180,583 | 541,000 | 74,833 |
| >2.50 | 1,732,807 | 701,491 | 939,596 | 202,631 |

Note: Credit limit from formal institutions and the amount borrowed from informal institution for different farm sizes are significant at 10 and 5 percent levels respectively (anova analyses).

The average credit limit and amount borrowed from the informal credit markets seems to be linked to farm size. The larger the farm size, the higher the credit limit and amount borrowed. The average credit limit and amount borrowed by the households with farm sizes of less than 0.51 ha. are 126,448 and 96,741 rupiah respectively. This confirms the fact that the households almost reach their credit limit (with approximately 23 percent left). In contrast, for groups which control more than 2.50 ha. farm size, the gap between the average credit limit and amount borrowed is large. The unused credit lines are approximately 498,860 rupiah (71 percent).

### 6.3.3 Distribution of Borrowers by Assets

Asset ownership is considered an important determinant of household access to formal credit markets. Tabel 6.10 depicts the distribution of the households' access to and participation in either formal or informal credit markets by tercile value of assets. There is a close correlation between the value of household assets and household access to formal credit. A household's access to formal credit markets seems to increase with the value of assets owned. For the first group of households, only 13 percent have access, while in the case of the third group with the largest assets value, 34 percent have access.

Table 6.10.Distribution of the Households' Access to and Participation in Credit Market by Tercile Assets

| | Tercile of assets[a] | | |
|---|---|---|---|
| | 8-679.5 (Low) | 683-2,148.5 (Medium) | 2,157.7-34,600 (High) |
| Total households | 97 | 98 | 98 |
| Formal credit | percentage of total households | | |
| a. access | 13 | 17 | 34*** |
| b. participating | 6 | 13 | 26*** |
| Informal credit | percentage of total households | | |
| a. access | 75 | 74 | 67 |
| b. participating | 47 | 46 | 32*** |

Notes: [a] tercile assets is in 10000 Rupiah
*** significant at 1 percent level

Corresponding to the access, the trend of the households participating in the formal credit market seems have a similar pattern. However, not all the households which have access participated in the formal credit markets. This can be seen by the difference between access and participation within each group. The percentage of households from the 'high' asset category that participated was 26 percent, while only 6 percent of the households from the lowest groups participated.

A different pattern emerges in the informal credit markets. The values of assets is not an important indicator of having access to credit. The percentage of households which have access to informal institutions is not related to the asset value.

The analysis of variance verifies that there is no statistical difference in the means for each group. This differs respecting participation in the informal credit markets. It is more likely that households in the lowest asset groups participate with 47 percent of the households in this groups participating.

Table 6.11 provides information about the credit limit and amount money borrowed either from formal or informal credit institutions according to household assets ownership.

The maximum loans that could be borrowed by the high groups is 2,152,500 rupiah, which is clearly different from the lowest groups where this value is only 161,752 rupiah. The analysis of variance confirms that the credit limit means among poverty groups are different and statistically significant at 1 percent level. The amount of money borrowed has a similar pattern with the credit limit: the highest group borrowed more than the lowest group.

In the informal credit markets, the average credit limit within different groups shows that only relatively limited loans could be borrowed, less than 1 million rupiah. For the lowest group of asset ownership, the amount of money borrowed is greater than in the case of the highest group, 84,123 and 79,438 rupiah respectively. This fact confirms the fact that households belonging to lowest group almost reach their credit limit (with approximately only 14 percent left).

Tabel 6.11 Average Credit Limit and Amount Borrowed, by Assets Ownership Tercile

| | Tercile of Assets[a] | | |
|---|---|---|---|
| | 8-679.5 (Low) | 683-2,148.5 (Medium) | 2,157.7-34,600 (High) |
| Formal credit | | | |
| a. credit limit | 161,752 | 573,044 | 2,152,500*** |
| b. amount borrowed | 101,701 | 330,952 | 1,203,734*** |
| | | | |
| Informal credit | | | |
| a. credit limit | 98,082 | 146,326 | 505,153 |
| b. amount borrowed | 84,123 | 137,480 | 79,438 |

Notes: [a] tercile assets is in 10000 Rupiah
*** significant at 1 percent level

### 6.3.4 Distribution of Borrowers by Poverty Groups

Tables 6.12 and 6.13 show that the "access to credit" indicator is really associated with the welfare situation. The wealthier the households are, the better their access to the formal credit markets, and informal credit markets tend to provide money to the poorest groups. The difference in the households' access to formal and informal credit markets differentiated by the household welfare situation describes this phenomenon.

Tabel 6.12 Distribution of the Households' Access to and Participation in Credit Market, by Poverty Groups

| | Poverty groups | | |
|---|---|---|---|
| | The poorest | Poor | Less poor |
| Total household | 96 | 99 | 98 |
| Formal credit | | | |
| a. access | 14 | 13 | 38*** |
| b. participating | 6 | 10 | 28*** |
| Informal credit | | | |
| a. access | 78 | 81 | 58*** |
| b. participating | 49 | 46 | 30*** |

*** significant at 1 percent level

Only 14 percent of the poorest have access to formal credit markets, while 38 percent of the less poor households do. In contrast, 78 percent of the poorest and 58 percent of the less poor households have access to informal credit markets.

Coupled with the access to formal loans, the amount borrowed was also related to the households' welfare. For the poorest there seems to be no access to formal credit. In the rural areas it is believed that the poorest households are riskier borrowers with less assets, in part because they are not able to provide any collateral

Table 6.13. Average Amount of Credit Limit and Amount Borrowed, by Poverty Groups in Central Sulawesi.

| Poverty groups | Credit limit (Rp) | | Amount borrowed (Rp) | |
|---|---|---|---|---|
| | Formal | Informal | Formal | Informal |
| Poorest | 83,906 | 120,093*** | 27,812 | 98,447*** |
| Poor | 411,234 | 120,808*** | 228,396 | 119,414.*** |
| Less Poor | 2,388,021 | 508,,877*** | 1,378,399 | 165,683*** |

* significant at 1%

## 6.4 The Determinants Households' Access to and Participation in Informal Credit Markets"

This section was preceded by a chapter presenting selected socio-economic characteristics of the sample households, differentiated by households with and without access to informal credit and households which did or did not borrow loans (participate).

The average household size in the survey area is 5 persons. The same is true in the case of the households with access to and that participate in the informal credit markets. Households which participate in informal credit markets have the highest dependency ratio, 0.8. This means that these households are more dependent compared with others.

The average age of the head of the household respecting households which have access to and that participate in the informal credit market is younger. For those households which have access, the average age is 42, which is eight years younger than those with no access. The average age of the head of the participating households, is also 4 years younger than in the case of the households that did not participate.

Table 6.14. Demographic Characteristics of Households

| | Household | | Household | | |
|---|---|---|---|---|---|
| | Has access | Has no access | Participates | Does not participate | All |
| Sample size | 212 | 81 | 122 | 171 | 293 |
| Family size | 5.4 | 5.3 | 5.0 | 5.6 | 5.3 |
| Dependency ratio | 0.7 | 0.7 | 0.8 | 0.6 | 0.7 |
| Age of head of household | 42 | 48 | 40.2 | 46.2 | 43.7 |
| Education | 3.6 | 4.4 | 3.6 | 4.0 | 3.8 |
| | | | Percent | | |
| **First occupation** | | | | | |
| Self-employed in agr. | 79.2 | 65.4 | 77.0 | 74.3 | 75.4 |
| Self-employed (non farm enterprise) | 2.8 | 2.5 | 0.8 | 4.1 | 2.7 |
| Government worker | 1.4 | 13.6 | 0.8 | 7.6 | 4.8 |
| Salaried worker in agriculture | 8.0 | 6.2 | 11.5 | 4.7 | 7.5 |
| Salaried worker in non-agriculture | 5.7 | 2.5 | 6.6 | 3.5 | 4.8 |
| Casual worker | 0.5 | 1.2 | 0.8 | 0.6 | 0.8 |
| Other | 0 | 8.6 | 0 | 5.3 | 4.0 |
| **Second occupation** | | | | | |
| Self-employed in agr. | 6.6 | 17.3 | 5.7 | 12.3 | 9.6 |
| Self-employed (non-Farm enterprise) | 10.8 | 12.3 | 9.8 | 12.3 | 11.3 |
| Government worker | 0 | 0 | 0 | 0 | 0 |
| Salaried worker in agriculture | 12.3 | 9.9 | 16.9 | 9.9 | 11.6 |
| Salaried worker in non-agriculture | 9.9 | 7.4 | 12.3 | 7.0 | 9.2 |
| Casual worker | 9.9 | 8.6 | 13.1 | 7.0 | 9.6 |
| Other | 0.9 | 2.5 | 0.8 | 1.8 | 1.4 |
| No secondary Occupation | 49.5 | 42.0 | 44.3 | 49.7 | 47.4 |

The average educational level of those household heads who did either have access to or participate in informal credit markets was 3.6 years. This number is lower than that regarding households which had no access and do not participate.

From the table 6.14, it also can be seen that farmering is the main occupation among the household samples: 79.2 and 77.0 percent for households with access and who participated, respectively. Households really rely on the first occupation; almost 47 percent of the sample households have no second occupation.

Table 6.15 presents a number of descriptive statistics for variables used in the Probit model. An overview of some variables by differentiation between households with access

to the informal credit markets and with no access aims at better understanding the two different groups better.

Tables 6.15 Descriptive Statistics of Explanatory Variables, Differentiated by Access to Credit

| Variables | Household has access (N=212) | Household has no access (N=81) | Sig. level |
|---|---|---|---|
| Age of head of household (years) | 42 (13.8) | 48 (14.3) | 0.01 |
| Education of head of household | 3.6 (1.8) | 4.4 (1.9) | 0.06 |
| Unemployment dependency ratio | 0.07 (0,15) | 0.17 (0.21) | 0.00 |
| Female head of household | 0.05 (0.21) | 0.02 (0.15) | 0.32 |
| Family size | 5.4 (2.06) | 5.3 (2.00) | 0.81 |
| Ln value of assets | 16,12 (1.37) | 16.41 (1.51) | 0.11 |
| Distance to road | 0.90 (2.72) | 0.92 (2.52) | 0.94 |

Note: number in parentheses is standard deviation of variable

Table 6.16 reports the results of the estimation of the determinants of households' access to informal credit markets using a Probit model. The dependent variable is a dummy variable with a value of 1 if the households has access to credit and 0 otherwise, as measured by credit limit. Four out of seven variables are statistically significant in determining access to informal credit markets. The coefficient for the age of the head of a household is negative and significant, which confirms that older households have a lower probability of having access. It seems that lenders choose the younger households to reduce the potential losses. The coefficient for the education of the head of a household is negative and significant, indicating that households with less education have more likely access to informal credit markets. The informal lender knows that the lowest educated households tend to follow all the procedures necessary to be engaged in informal credit markets, while sometimes not realizing that the interest rate for informal credit is higher compared with formal credit markets, but the process of getting money from informal lenders is much easier.

Table 6.16 Determinants of the Households' Access to Informal Credit Markets

| Variables | Coefficient | t-value | Marginal effect |
|---|---|---|---|
| Constant | 1.774 | 1.76* | |
| Age of head of household (years) | - 0.233 | -3.41*** | -0.007 |
| Education of head of household | -0.153 | -3.15*** | -0.049 |
| Unemployment dependency ratio | -1.194 | -2.46** | -0.387 |
| Female head of household | 0.314 | 0.69 | 0.915 |
| Family size | 0.074 | 1.72* | 0.239 |
| Ln value of assets | 0.013 | 0.20 | 0.004 |
| Distance to road | -0.031 | -0.99 | -0.010 |
| Chi squared | 34.46 | | |
| p-value | 0.000 | | |
| Pseudo R squared | 0.10 | | |
| Log likelihood | -155.50 | | |
| Observations | 293 | | |

Notes: Marginal effects in percentage points, calculated at sample means
***, ** and * are significant at 1, 5, and 10 percent level respectively.

It is interesting to note two variables that have different signs: the unemployment dependency ratio is negative and significant while family size has a positive sign. The negative sign for the unemployment dependency ratio means that a household with a lower unemployment dependency ratio has a higher probability of having access to an informal lender, similar to other risk bearing indicators such as age. This variable can be easily observed by the lender due to the close relationships between lenders and borrower, as explained in the preceding section. At the same time, a larger family size increases the probability of the households' access to informal credit. One function of the informal lender in the rural area is to relieve the short-run lack of capital faced by households. The lender tends to provide credit to households that face short-run financial problems. Households with a greater number of family members are one of the outreach goals of the informal lender with the purpose of assisting their financial problems.

The coefficient total value of assets is positive but insignificant. That means that asset ownership is not an important indicator for an informal lender before he decides whether

to lend their money or not. As shown in the descriptive analyses, sometimes the informal lenders provide some money without any certain obligations. The reason for such acts is simply the awareness of human relations.

The distance from a home to the closest road has a negative sign but is insignificant. The distance from the road is a proxy for the infrastructure development of the region in which the household is located.

The marginal effects display the slope of the probability function at sample means. For example, the coefficient of the marginal effect for the education of the head of the household is -0.049. This means that an increase of one year of education of the head of the household reduces the probability of having access to the informal credit markets by 0.049 percent.

Table 6.17 displays a number of descriptive statistics for the variables differentiated according to households which participate and households which do not participate.

Table 6.18 presents the estimated households participating in the informal credit markets. The dependent variable is a dummy variable which is 1 if the household participates in the formal credit markets, indicated by having borrowed some money and 0 otherwise.

Tables 6.17 Descriptive Statistic of Explanatory Variables

| Variables | Household participates (N=122) | Household does not participate (N=171) | Sig. level |
|---|---|---|---|
| Age of head of household (years) | 40.3 (12.44) | 46.3 (14.82) | 0.00 |
| Education of head of household | 3.6 (1.7) | 4.0 (1.9) | 0.10 |
| Unemployment dependency ratio | 0.08 (0.15) | 0.11 (0.19) | 0.31 |
| Female head of household | 0.03 (0.8) | 0.05 (0.21) | 0.55 |
| Family size | 5.00 (1.9) | 5.63 (2.10) | 0.01 |
| Number of organisations involved | 2.76 (2.5) | 3.02 (3.02) | 0.43 |
| Distance to road | 1.06 (3.02) | 0.79 (2.38) | 0.39 |
| Poverty index | -0.26 (0.81) | 0.18 (1.07) | 0.00 |
| Food shortage (days) | 1.81 (3.31) | 0.84 (2.15) | 0.00 |

Note: number in parentheses is standard deviation of variable

Several variables are significant in determining the household's participation in the informal credit markets. The probability of participating in the informal credit market is reduced along with the higher education of the head of the household. A household with a higher level of education has broader knowledge about the informal sector, and they are afraid to be trapped by moneylenders.

The positive coefficient of the poverty index as a proxy for welfare status supports the above view concerning the relationship between human capital and welfare status. The wealthier households tend to reduce participation in the informal credits markets. Unlike in the case of access to informal credit, the coefficient of family size is negative and significant for participation. A larger family size corresponds to a reduced probability of participating in the informal credit market.

Table 6.18 Determinants of the Households Participating in Informal Credit Markets

| Variables | Coeff | t-value | Marginal effect |
|---|---|---|---|
| Constant | 1.116 | 2.78*** | |
| Age of head of household (years) | - 0.016 | -2.60*** | -0.006 |
| Education of head of household | -0.079 | -1.64* | -0.073 |
| Unemployment dependency ratio | 0.307 | 0.64 | 0.119 |
| Female head of household | -0.720 | -1.57 | -0.241 |
| Family size | -0.087 | -2.07** | -0.034 |
| Number of organisation involved | 0.016 | 0.53 | 0.006 |
| Distance to road | -0.008 | -0.28 | -0.003 |
| Poverty index | -0.153 | -1.63* | -0.059 |
| Food shortage (days) | 0.079 | 2.39** | 0.031 |
| Chi squared | | 35.49 | |
| p-value | | 0.000 | |
| Pseudo R squared | | 0.09 | |
| Log likelihood | | -184.260 | |
| Observations | | 293 | |

Notes: Marginal effects in percentage points, calculated at sample means
***, ** and * are significant at 1, 5 and 10 percent level respectively.

The coefficient for food shortage, which refers to a 12 month recall period reported by households which faced a lack of food (in days), is positive and significant and indicates that households which face problems related to fulfilling their basic needs are more likely to borrow money from an informal lender. This result verifies that the informal lender is an important agent in providing money to the poorest households which have problems with an economic crisis.

# 7. Smallholders Access to Formal Credit Markets and Its Impact on The Adoption of Agricultural Technology and Land Use Decisions

## 7.1 Agriculture Practice and Technology in Paddy Field–lowland

This chapter describes the agricultural practices in the research area and identifies household characteristics that influence the adoption of agricultural technology. Growing concerns over environmental sustainability of agricultural practices arise with the increasing pressure on forest area. Prior research showed that if the agricultural land in the lowland area is intensively cultivated, this will reduce the probability that households encroach into forest areas (Maertens, 2004). Therefore, the main focus of the analysis in the lowland area will be on the intensification of agriculture where the most common crop planted by the household is paddy. In most cases, the adoption of technology for agricultural activities refers to one bundle of technology consisting of high yield varieties, fertilizer, irrigation, pesticides, and land preparation practices. In section 7.1, only the sub-sample of 116 households which cultivate paddy land is considered in the analysis.

### 7.1.1 Land Preparation

We can distinguish three common types of agricultural technology that are used for land preparation: 1) the use of a hand tractor 2) manual labor accomplished with some tools and 3) the use of animals. Table 7.1 presents the different types of technology used for

land preparation, differentiated by area of paddy cultivated. From the table it can be seen that for larger areas of paddy, farmers tend to apply modern technology. The average area of land owned by farmers who owned more than 1.0 ha. and used a hand tractor is 1.11 ha., and this group represents 40 percent of the >1.0 ha. group.

116 households out of the total household sample were counted related to their agriculture activity in the wet-land area. Only 29 percent of the farmers who control a cultivated area of less than 0.5 ha. use hand tractors. In this activity, farmers who do not own a hand tractor have the possibility of renting one, either through farmers' organisations or from individuals. A common agricultural practice and technology beside the hand tractor is the use of animals. More than 50 percent of the farmers who cultivated an area of less than 0.5 ha used an animal in land preparation.

Table 7.1. Land Preparation Technology, Differentiated by Farm Size

| Technology | Farm Size (ha.) | | | |
|---|---|---|---|---|
| | < 0.50 (N=34) | 0.50-1.00 (N=72) | >1.00 (N=10) | Sig.Level |
| Hand tractor (ha.) | 0.067 | 0.28 | 1.11 | 0.00 |
| Manual (ha.) | 0.04 | 0.04 | 0 | 0.69 |
| Animal (ha.) | 0.13 | 0.32 | 0.7 | 0.01 |
| | | % of households | | |
| Hand tractor | 29 | 43 | 40 | 0.17 |
| Manual | 18 | 1 | 0 | 0.12 |
| Animal | 53 | 46 | 40 | 0.75 |

### 7.1.2 Improved Varieties, Chemical Fertilizer, and Pesticide

Table 1 depicts the different types of technology applied in agricultural practices in paddy fields differentiated by poverty groups. The type of seed determines the potential yield. Farmers are aware of this situation and most of them use an improved variety. Therefore, from the analysis of variance, there is no significant difference among the poverty groups. More than 90 percent of the poorest households use this type of seed as well as 76 and 89 percent of the poor and less poor groups respectively.

Table 7.2 Type of Technology, Differentiated by Poverty Groups

| Technology type | % of households belonging to: | | | |
|---|---|---|---|---|
| | the poorest (N=21) | poor (N=51) | less poor (N=44) | Sig.Level |
| Urea | 38 | 43 | 68 | 0.01 |
| Pesticide | 42 | 67 | 77 | 0.02 |
| Urea and pesticide | 29 | 37 | 64 | 0.01 |
| Improved variety | 90 | 76 | 89 | 0.21 |
| No urea and no pesticide | 48 | 27 | 18 | 0.04 |

Fertilizer is needed for vegetative development. (Rehm and Espig 1991) reported that the nutrient removed most by a one ton rice harvest is N (Nitrogen). One type of chemical fertilizer that is often used by farmers is urea. Urea contains 46% nitrogen and is the cheapest source of mineral N. For these reasons, farmers prefer to utilize this type of fertilizer.

More wealthy households are more likely to apply more advanced technology. 68 percent of the less poor group used urea on their fields, while only 38 percent of households belonging to the poorest group applied urea. 51 percent of all of the farmers applied urea. A proxy for pesticide use is the amount of money spent to buy these pesticides. The same pattern is found regarding pesticide use: the better the household situation, the more pesticides they use. Interestingly, the percentage of households across all poverty groups which applied pesticides was higher than the percentage that used urea. 61 percent of all of the rice farmers utilized pesticides.

The last row in table 7.2 includes farmers who did not apply any technology (urea or pesticides). The percentage of the poorest who did not apply urea and pesticides was 48 percent.

Table 7.3 Type of Technology, Differentiated by Farm Size

| Technology | Farm size (ha.) | | | |
|---|---|---|---|---|
| | < 0.50 (N=34) | 0.50-1.00 (N=72) | >1.00 (N=10) | Sig.Level |
| Urea kg/ha. | 46.54 | 53.66 | 82.77 | 0.34 |
| Pesticide Rp/ha. | 81,390 | 56,011 | 58,177 | 0.29 |
| | | % of households | | |
| Urea | 38 | 56 | 80 | 0.04 |
| Pesticide | 53 | 69 | 90 | 0.06 |
| Urea and pesticide | 29 | 49 | 80 | 0.01 |
| Improved variety | 82 | 84 | 80 | 0.90 |
| No urea and no pesticide | 38 | 24 | 10 | 0.13 |

Table 7.3 presents the percentage of households using different types of technology. Again, three groups of farm size were considered. The average amount of urea applied per hectare increases from 46.5 kg on small farms to 82.3 kg on farms greater than one hectare. However, across all farm sizes, the quantity of urea sowed is still below the amount recommended by the regional agricultural extensions service (BPTP) which is 120 kg/ha. However, these guidelines may have the objective of maximizing rice yields to better attain the national rice sufficiency objective but have little to do with optimal use intensity levels from a micro-economic (i.e., farmer's) perspective.

The table shows that – for all types of technology - the percentage of households using a technology increases with farm size.

## 7.2 Overview of Factors that Influence the Adoption of Agriculture Technology

This section give detail explanations and a descriptive analysis of the different factors which influence the adoption of agricultural technology such as the infrastructure, human capital, social capital, and access to formal credit markets.

### 7.2.1 Infrastructure

As Maerten (2004), who was quoted by Schwarze (2004), reported, there are two main asphalt roads connecting the capital city of Central Province, Palu, with the research area. One road crosses south along the western side of the national park and connects the

sub-district of Kulawi with Palu. The other road links Palolo and Lore Utara along the eastern side of the national park.

Table 7.4 Distance to a Tarmac Road Differentiated by Sub-district (Hours)

| Sub-district | Min | Max | Mean | Std.dev |
|---|---|---|---|---|
| Lore Utara | 0 | 1 | 0.09 | 0.2 |
| Palolo | 0 | 2 | 0.36 | 0.6 |
| Sigi Biromaru | 0 | 0.2 | 0.01 | 0.05 |
| Kulawi | 0 | 1 | 0.07 | 0.23 |
| Total | 0 | 2 | 0.09 | 0.3 |

Number of observations: 116

The condition of the infrastructure within the sub-district varies, ranging from an asphalt road to a narrow trail where there is no possibility of transportation with a vehicle. Table 7.4 gives information about the walking distance from a homestead to the nearest tarmac road. The average time it takes for a household which lives in the sub-district Palolo to reach the closest tarmac road is 0.36 hours, which is greater than in other sub-districts. In contrast, in Sigi Biromaru, households only spend 0.01 hours to reach the closest tarmac road. The accessibility of those households is good enough and they are located near the capital city, Palu.

Looking in detail at the accessibility at the plot level, the table depicts the time spent to reach paddy fields. The average time to reach a plot is 45.5 minutes for the overall sample. The households which live in Kulawi spent more than households in other sub-districts. Table 7.5 shows accessibility at the plot level which is denoted by the time spent reaching the plot from home. The average time which is needed to reach a plot walking is 101.1 minutes (more than 1.5 hours). The amount of time spent walking from a home to a plot influences farmers in their decision to adopt a certain technology. For example, fertilizer is a bulky technology, and to carry fertilizers to their plots farmers need more effort. They need even more if the condition of the infrastructure is not good enough to support this activity.

Table 7.5 Plot Distance from Home (minutes)

| Sub-district | Min | Max | Mean | Std.dev |
|---|---|---|---|---|
| Lore Utara | 0 | 151.6 | 32.6 | 26.6 |
| Palolo | 7.04 | 102.0 | 29.9 | 24.9 |
| Sigi Biromaru | 0 | 113.21 | 31.61 | 29.6 |
| Kulawi | 11.2 | 500 | 101.1 | 117.7 |
| Total | 0 | 500 | 45.5 | 63.4 |

Number of observations: 116

### 7.2.2.Access to Financial Markets

This section will focus on the descriptive analyses of the influence of the formal credit market on the adoption of agricultural technology. Since the amount of money borrowed from informal institutions is limited and the time periods often short term, the role and existence of the formal credit markets are necessary to fulfil the demand for investments in agricultural activities. Table 7.6 gives information on rice farmers who have access to and participate in formal credit markets, differentiated by the size of area cultivated with paddy.

The cultivated areas of paddy do not necessarily correspond with the percentage of households which have access to credit. Of the households which control cultivated land between 0.50-1.00 ha., only 17 percent had access to formal credit markets. In the case of the group of households that cultivate areas of land smaller than 0.5 ha., 35 percent had access. As has been pointed out in section 6.1.2, one source of formal credit is the government credit programme (KUT) whose target is smallholders. This phenomenon is a good indication that the programme is succeeding in reaching the target group.

Table 7.6 Distribution of Households Access to and Participation in Formal Credit Markets, Differentiated by Farm Size

| | Farm size (ha.) | | | |
|---|---|---|---|---|
| | < 0.50 (N=34) | 0.50-1.00 (N=72) | >1.00 (N=10) | Total |
| Access (%) | 35 | 17 | 50 | 25 |
| Participating | 26 | 14 | 40 | 20 |
| Amount borrowed (Rp) | 706944 | 437795 | 1855000 | 638856 |

The same pattern was found concerning households which participated in formal credit markets. However, the percentage of households participating in the third group (> 1.00 ha.) was higher than in the other groups. This explains the fact that the larger the size of land cultivated, the more loans are needed as working capital to enhance agricultural activities. The average amount of money borrowed by rice farmers from formal credit markets was 638,856 rupiah. The households which cultivate more than 1.0 ha. borrowed 1,855,000 rupiah, the highest amount among all the groups.

### 7.2.3 Human Capital

Human capital is one important resource for generating income. Table 7.7 shows some human indicators, differentiated by poverty groups. The age and the education of the household head are not significantly different among the three groups. The same is true regarding the percentage of adults who never attended school and those who completed primary school. Among the poorest, poor, and less poor, the values are not significantly different. It is a common phenomenon in rural areas that during their growing period, children from all social strata are sent to primary school.

The common belief is that primary school is enough for the children to be able to read, write, and do simple calculations. However, a higher education among the adults in the household influences the household's ability to generate income, as indicated in the table. The percentage of adults who completed secondary and high school in the less poor group was higher than in the poorest group.

Table 7.7 Human Capital Indicators, Differentiated by Poverty Groups

| Human capital indicator | % of households belonging to: The poorest (N=21) | Poor (N=51) | Less poor (N=44) | Sig.Level |
|---|---|---|---|---|
| Age of head of household | 48 | 48 | 53 | 0.19 |
| Education of head of household | 3.2 | 3.7 | 4.2 | 0.12 |
| Percentage of adults ... | | | | |
| Never attended school | 5.9 | 5.8 | 4.9 | 0.93 |
| Completed primary school | 77.8 | 85.6 | 83 | 0.52 |
| Completed secondary school | 16.7 | 35.6 | 43.3 | 0.10 |
| Completed high school | 4.8 | 12.8 | 23.3 | 0.10 |

Table 7.8 shows the same indicators for human capital as presented in the previous table. However, it is differentiated by farm size. The values for all elements are not significantly different among the three groups.

Table 7.8 Human Capital Indicators, Differentiated by Farm Size

| Human capital indicator | Farm size (ha.) < 0.5 (N=34) | 0.5-1.0 (N=72) | >1.0 (N=10) | Sig.Level |
|---|---|---|---|---|
| Age of head of household | 49.4 | 49.0 | 57.6 | 0.21 |
| Education of head of household | 3.9 | 3.8 | 4.1 | 0.85 |
| Percentage of adults ... | | | | |
| Never attended school | 4.2 | 6.4 | 3.3 | 0.67 |
| Completed primary school | 87.2 | 80.6 | 88.8 | 0.37 |
| Completed secondary school | 28.2 | 36.7 | 47.2 | 0.27 |
| Completed high school | 16.7 | 13.2 | 26.0 | 0.28 |

### 7.2.4 Social Capital

Social capital reflects the social relationships and networks among households. The degrees of intensity with which a household interacts influences the sharing of information. Therefore, one of the possibilities to channel information is through organisations in which the household is involved. Table 7.9 shows different types of organisations differentiated by whether the head of the household and their spouse are actively involved. There are four different types of organisations established in each village. The first type includes religious groups where the activities are concerned with

religion and where there is a meeting at least once a week. The second type of organisation are farmers' groups. Each village has this type of organisations, and the activities focus on agricultural activities such as organising a meeting with the extension services, planning to distribute information among members, and managing water distribution from the irrigation channels. The third type of group includes neighbourhood groups, such as saving groups (arisan) and PKK.

The most important groups in which the head of a household and his spouse were involved were religious groups with 75.9 and 70.9 percent of the heads and spouses participating, respectively. For the head of a household, farmers' organisations are the second most important group with 13.8 percent of the sample engaged in this type of organisations. In contrast, 25.3 percent of the spouses consider neighbourhood groups the most important organisations. The second most important organisations based on the response of the heads are farmers' organisations with 33.3 percent. The second most important is by religious groups with 25.6 percent. However, farmers' organisations are not the type of organisation that most spouses are interested in.

They explained that the advantage of being involved and active in the different organisations was that they could at least meet each other, and some of them also mentioned that they could exchange information related to agricultural activities.

Table 7.9 Type of Organisations in Which Households Are Involved

| Type of organisation | Head of household | Spouse |
|---|---|---|
| Most important | | |
| 1. Religious groups | 75.9 | 70.9 |
| 2. Farmers' organisations | 13.8 | - |
| 3. Neighbourhood groups | 3.4 | 25.3 |
| 4. Other groups | 6.9 | 3.8 |
| **Total** | | |
| Second important | | |
| 1. Religious groups | 25.6 | 25.9 |
| 2. Farmers' organisations | 33.3 | - |
| 3. Neighbourhood groups | 17.9 | 66.7 |
| 4. Other groups | 23.1 | 7.4 |
| **Total** | 100 | 100 |

## 7.3 Determinants of Smallholders' Access to Formal Credit Markets

The following section presents econometric analyses which examine: (1) factors that influence household access to formal credit; (2) determinants of the amount of money borrowed from formal credit institutions; and (3) the impact of the household access to formal credit on the adoption of technology, with a focus on the amount of urea applied and expenditures for pesticides.

The results of the Probit estimation can be seen in Table 7.11. Assets ownership, which is calculated in monetary terms, as a proxy for the welfare status of a household has a positive effect on the household's access to formal credit with a 10 percent level of significance. The positive sign indicates that the probability of a household having access to formal credit increases with increasing welfare. Since access to credit is the supply side, this result can be interpreted to mean that formal credit institutions tend to provide money to the wealthier households. This fits to the assumption that the wealthier households as borrowers are not as risky because they are able to pledge the loan requirement by providing collateral.

Table 7.10 Descriptive Statistics of Explanatory Variables

| Variable | Min | Max | Mean | Std Dev |
|---|---|---|---|---|
| Family size | 1 | 13 | 5.36 | 2.04 |
| Age of head of household | 20 | 83 | 43.75 | 14.17 |
| Education of head of household | 1 | 8 | 3.85 | 1.86 |
| Female head of household | 0 | 1 | 0.04 | 0.19 |
| Assest value | 80,000 | 346,000,000 | 24,000,000 | 35,200,000 |
| Land title | 0 | 1 | 33.7 | 47.3 |
| Distance to road | 0 | 13 | 0.90 | 2.67 |

Family size, as a proxy for the risk bearing capacity of each household, has the expected sign. The negative sign of this variable means that large family size tends to reduce the probability of a household's access to formal credit.

Table 7.11 Probit Estimation of Determinants of Smallholders' Access to Formal Credit

| Variable | Coefficient | t value | Marginal effect |
|---|---|---|---|
| Constant | - 4.353 | **-3.32*** ** | |
| Family size | - 0.077 | -1.51 | -0.02 |
| Ln assets value | 0.136 | **1.65*** | 0.03 |
| Age of head of household (years) | 0.014 | **1.94**** | 0.003 |
| Education of head of household (years) | 0.246 | **4.63*** ** | 0.06 |
| Female head of household | - 0.635 | - 0.97 | -0.11 |
| Land title (dummy) | 0.097 | 0.47 | 0.02 |
| Distance to road (hours) | -0.004 | -0.11 | -0.01 |
| Chi squared | | **39.24** *** | |
| Pseudo R squared | | 0.14 | |
| Log likelihood | | - 120.53 | |
| Observations | | 293 | |

Notes: Marginal effects in percentage points, calculated at sample means
*** and * are significant at 1 and 10 percent level respectively

Variables representing human capital such as age and the education of the head of a household have positive signs. The probability of having access to credit increases with an increase in the education or age of the head of the household. The high degree of significance and the high marginal effect of the educational level of the head of the household confirm that of all of the variables that influence the household's access to credit, level of education variable is the most important. Lenders tend to choose clients with a better education. This variable is an important requirement along with collateral. The complexity of being involved in formal credit markets requires a good understanding of the procedure. This is confirmed with the higher marginal effect of education compared to others variables. The value 0.06 means that an increase in the education of a head of the household by one year leads to a 0.06 percentage point increase in the probability of having access to formal credit markets.

## 7.4 Two Step Model of Determinants of Amount of Money Borrowed from Formal Credit Markets

The results of the two step estimation using the selectivity bias approach can be seen in Table 4. The decision of a household to borrow a certain amount of money is based on a set of variables which reflect the demand side. Table 7.12 shows the descriptive statistics of the explanatory variables in the OLS model.

Table 7.12 Descriptive Statistics of Explanatory Variables

| Variable | Min | Max | Mean | Std Dev |
|---|---|---|---|---|
| Number of adults | 2 | 8 | 4.02 | 1.63 |
| Age of head of household | 20 | 80 | 46.93 | 13.71 |
| Income per capita | 28178 | 5933945 | 1512568 | 1189662 |
| Formal institutions (Dummy) | 0 | 1 | 0.57 | 0.51 |
| Area cultivated | 0 | 5.15 | 1.57 | 1.29 |
| Land title | 0 | 100 | 50.99 | 45.57 |
| IMR | 0.47 | 1.83 | 1.13 | 0.38 |

Four variables out of seven are statistically significant as determinants of the amount borrowed. The amount of money borrowed from formal institutions increases simultaneously with increasing household per capita income. Higher income per capita means that the needs of the household are more diverse. There is an increased demand not only for food but also for more luxury consumer goods; therefore, the demand for loans increased.

The effects of collateral can be seen by the percentage of land owned which has an accompanying land title. This variable is significantly and positively related to the amount of money borrowed, meaning that the greater the amount of titled land owned, the greater the amount of money borrowed. As explained by many authors, one consideration for participating in formal credit institutions is the availability to provide collateral. (Deininger and Feder 1998; Meyer 1990) stated that the provision of collateral, which is facilitated by the possession of a formal land title, is generally a necessary condition for the participation in formal credit markets for medium and long-

term loans. As a result, an increasing amount of land title ownership increases the amount of money borrowed. Moreover, this result confirms the hypothesis that well- defined land property rights are important for the functioning of a perfect land market. Indeed, a clear system of legal and transferable land titles is needed.

Table 7.13. Two Step Model Estimation of Determinants of Amount of Money Borrowed from a Formal Credit Market

| Variable | Coefficient | t value |
|---|---|---|
| Constant | 12.514 | **13.32** |
| Number of adults (persons) | 0.128 | 1.25 |
| Income per capita (Rp/cap) | 0.00002 | **1.85*** |
| Age of head of households (years) | -0.007 | -0.58 |
| Type of formal institutions (dummy) | 1.718 | **5.85***** |
| Area of cultivation (ha.) | 0.002 | **1.83*** |
| Land title (dummy) | 0.008 | **2.31 **** |
| Inverse Mills Ratio (IMR) | -0.438 | -1.04 |
| Adjusted R square | 0.39 | |
| F test (7,36) | **4.93***** | |
| Observations | 44 | |

*** , ** and * are significant at 1, 5, and 10 percent level respectively

The type of formal institutions where the borrower is a client is represented by a dummy variable and significantly determines the amount borrowed. The positive sign demonstrates that the households which are clients of the BRI-UD took out more loans than clients of other formal institutions, even though the microfinance institutions (such as BPR, Bank Perkreditan Rakyat) have the possibility to provide loans as high as the BRI-UD (with a maximum loan of 50 million rupiah).

The area cultivated as a proxy for economics scale of agricultural activities run by the farmer has a positive and significant effect in determining the amount of the loan. Larger-scale farming activities need either more working capital or investments to cover all costs.

The coefficient of inverse Mills' ratio is used to test the presence of a bias in the selection process of credit participants. The IMR in this model has a negative sign but is insignificant.

## 7.5 Recursive Model of Determinants of Adoption of Agricultural Technology

Table 7.14 gives information on the descriptive statistics for all explanatory variables while Table 7.15 presents the recursive model of the determinants of agricultural technology adoption. The recursive model estimated the rice farmer's activity to the adoption of technology. 116 households out of the total household sample are counted related to their agriculture activity in the wet-land area. The average urea applied in the paddy field was 54.1 kg/ha. the highest amount of urea applied was 400 kg/ha. This amount of urea applied is higher than the recommendation by BPTP.

Table 7.14 Descriptive Statistics of Variables (N = 116)

| | Min | Max | Mean | Std.Dev |
|---|---|---|---|---|
| **Dependent variable** | | | | |
| Urea applied (kg/ha.) | 0 | 400 | 54.1 | 68.4 |
| Pesticide expenditure (Rupiah/Ha.) | 0 | 437500 | 63637 | 78733 |
| **Independent variable** | | | | |
| Number of adults | 1 | 9 | 4.09 | 2.55 |
| Age of head of household | 21 | 83 | 49.9 | 14.38 |
| School attendance of head of households | 1 | 8 | 3.83 | 1.86 |
| Household ethnicity | 0 | 1 | 0.13 | 0.34 |
| Distance home to road (hours) | 0 | 5 | 0.13 | 0.45 |
| Distance home to plot (minutes) | 0 | 500 | 45.50 | 63.43 |
| Index of social capital | 0 | 1650 | 240.21 | 290.13 |
| Ln predicted amount borrowed | 11.85 | 16.80 | 13.31 | 0.99 |
| Dummy sub-district Kulawi | 0 | 1 | 0.22 | 0.42 |
| Dummy sub-district Palolo | 0 | 1 | 0.10 | 0.31 |
| Dummy sub-district Lore Utara | 0 | 1 | 0.34 | 0.47 |

Two models were estimated concerning technology adoption. The first employ the amount of urea used, measured in kilograms per hectare applied on rice fields during the past growing season. The second model estimates the determinants of pesticide expenditures per hectare of rice. Eleven variables were taken into consideration which represent social capital, human capital, access to financial markets, access to infrastructure, and dummy variables for sub-districts (to account for the influence of

other local characteristics). Seven variables are significant in determining the amount of urea used while six variables are significant in determining the amount spent on pesticides.

The predicted amount borrowed is significant as a determinant of the amount of urea applied, but not for pesticide expenditure although the sign of this variable is also positive. This means that the greater the amount of money borrowed, the more the household will spend to buy more urea.

This finding has the further implication that the roles of financial markets in financing agricultural technology adoption is important. Moreover, although the government should have certain programmes to maintain food security, the government does not need to provide the subsidized credit to farmers. Many cases across developing countries have shown that subsidized credit has often failed to achieve government objectives. One possible strategy could be to reduce the complexity of the administrative procedure so that the households would be more willing to be clients of formal credit institutions.

Social capital has a significant effect on the adoption of technology. Interaction among farmers in village organizations can be a medium for information exchange. (Feder, *et al.* 1985) emphasized that the farmers' decisions to adopt technology stem from dynamic processes such as information gathering, learning by doing, and accumulating resources. The positive sign of the index of social capital explains that a higher index corresponds to an increase in either urea used or pesticide expenditures. Farmers gain some advantages by being actively involved in village organisations. Information related to some procedure in using and applying a certain technology can be exchanged by the farmers during the meeting. As reported by some respondents (through personal interviews), some knowledge of agricultural practices was obtained from other farmers at the organisational meetings rather than from extension services which visited the farmers less often.

Table 7.15. Recursive Model of Adoption of Agricultural Technology

| | Urea applied | | Pesticide expenditure | |
|---|---|---|---|---|
| Variable | Coefficient | T value | Coefficient | T value |
| Constant | - 2.937 | -1.01 | 7.570 | 1.49 |
| Number of adults | -0.037 | - 0.26 | 0.601 | 0.19 |
| Age of head of household (years) | 0.029 | **1.99**** | **0.510** | **1.58*** |
| School attendance of head of households | -0.243 | **-1.72*** | -0.571 | **-1.83*** |
| Household ethnicity (dummy) | -0.427 | -0.78 | 0.449 | 0.41 |
| Distance home to road | -1.183 | **-2.75***** | -2.696 | **-2.85***** |
| Distance plot from home | -0.005 | -1.49 | -0.005 | - 0.67 |
| Index of social capital | 0.002 | **1.78*** | 0.005 | **2.62*** |
| Ln predicted amount borrowed | 0.634 | **2.53***** | 0.241 | 0.44 |
| Dummy sub-district Kulawi | -0.813 | -1.41 | -4.473 | **-3.50***** |
| Dummy sub-district Palolo | 1.868 | **3.48***** | 2.255 | **1.90*** |
| Dummy sub-district Lore Utara | -1.723 | **-3.35***** | -2.128 | **-1.88*** |
| Adjusted R squared | 0.30 | | 0.26 | |
| F (11,104) | **5.40***** | | **3.75** *** | |
| Observations | 116 | | 116 | |

***, ** and * are significant at 1, 5, and 10 percent level respectively

The age of the head of a household has a significant and positive effect which implies that the accumulation of location-specific farming knowledge is very important for the adoption of technology. Another variable "education," has a negative sign and is significant which indicates that farmers with more formal education tend to apply less fertilizer and spend less money on pesticides. This result may be partly explained by the fact that persons with an above-average education tend to obtain better-earning jobs in government, trade, or non-farm enterprises and, therefore, may consider agriculture a secondary employment and give less emphasis to farming. Both variables confirm that in the case of the adoption of technology in paddy activities, the experience in agricultural practices is more important than the formal education.

The infrastructure, represented by the distance from home to the closest tarmac road, is negative and significant at the 1 percent level. This indicates that the farther the household lives from the road, the less the members used urea and spent money on

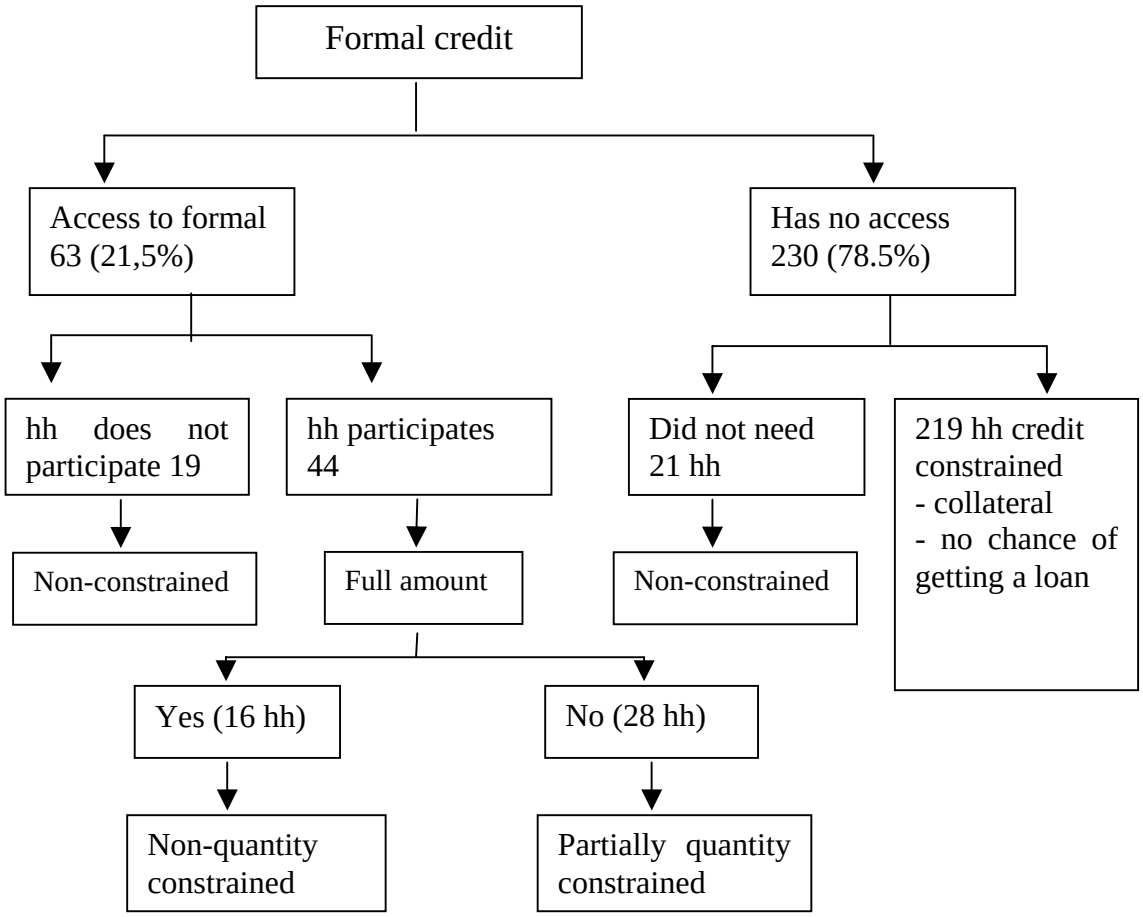
pesticides. It can be interpreted that they lack accessibility. As a result, the cost of transportation is increased and the price of inputs is more expensive compared to the households which have better accessibility. Another indicator of the accessibility represented by the distance from the house to the plot has a negative sign but is insignificant.

Some sub-district dummy variables are significant in influencing the amount of urea applied. The sub-district Palolo has a positive sign which implies that the rice farmers in this sub-district apply more urea than in other sub-districts.

### 7.6 Credit Constraints in Formal Credit Markets

This section presents the results of the empirical investigation of formal credit constraints in the rural areas of Central Sulawesi Province. Based on the classification proposed in the theoretical framework, figure 7.1 depicts detailed categories of household credit constraint.

Figure 7.1. Formal Credit Constraints in Rural Areas of Central Sulawesi Province




Notes: hh= household

The number of households with access to formal credit among the whole sample of households was 63 households or 21.5 percent. This means that those households gave a positive response when they were asked about the maximum amount of money they could borrow from any source of formal credit institutions. Of the 63 households, 44 households participated in the formal credit markets or borrowed from those institutions (as pointed out earlier in sub-section 6.2.3). Approximately 63 percent of the households (28 households) out of the total number of borrowers were classified as partially quantity constrained because they did not receive the full amount that they proposed to the lender.

On the right side of the figure, one can see that 78.5 percent of the household sample (230 households) had no access to formal credit markets. Those households can be classified either as credit constrained or non-constrained by looking at the detailed responses from the households. 18 households had no access credit and were classified as

non-credit constrained. They did not need to be engaged in the formal credit markets and mentioned that they had enough money. However, most of the households which had no access to formal credit were categorized as credit-constrained households (212 households). The various responses as to why the household was not involved in formal credit markets included a lack of collateral.

Descriptive statistics for the credit constrained and non-credit constrained households are provided to achieve a general overview of those households' characteristics. Table 7.16 provides a descriptive analysis.

Table 7.16 Socio-economic Characteristics of Households, Differentiated by Credit Status.

| | Credit constrained (N=237) | Non-credit constrained (N=56) | Sig.Level |
|---|---|---|---|
| **Demographic Characteristics** | | | |
| Age of head of household (years) | 43.4 | 45.2 | 0.40 |
| Family Size | 5.4 | 5.1 | 0.36 |
| School attendance of head of household | 3.8 | 4.2 | 0.10 |
| Dependency ratio | 0.71 | 0.67 | 0.67 |
| Number of adults | 3.72 | 3.68 | 0.87 |
| **Assets ownership and welfare** | | | |
| Value of total assets (Rp) | 22122728 | 321586884 | 0.09 |
| Value of livestock (Rp) | 2280793 | 1656785 | 0.78 |
| Size of land owned (ha.) | 1.84 | 2.16 | 0.26 |
| Area cultivated (ha.) | 1.50 | 1.61 | 0.58 |
| Wet land cultivated (ha.) | 0.32 | 0.41 | 0.23 |
| Upland cultivated with cocoa and coffee (ha.) | 1.11 | 0.99 | 0.50 |
| Total income (Rp) | 6210648 | 7419684 | 0.17 |
| Poverty groups | 1.95 | 2.25 | 0.01 |
| **Accesibility and land tenure** | | | |
| Distance house to road (hours) | 1.0 | 0.42 | 0.03 |
| Share of land completed with land title | 33.7 | 36.0 | 0.61 |

Some socio-economic characteristics which differ significantly between households which were credit constrained and those which were not are: school attendance of the

head of the household, the value of the total assets, poverty group, and distance from house to road.

### 7.6.1 Determinants of Formal Credit Constrained Households

Table 7.17 shows the maximum likelihood estimates of the Probit model. All variables used to explain the household formal credit constraint are a response to both demand and supply-side circumstances and have the expected signs, except for the percentage of land owned and secured with a land title. In this model, the coefficients of four out of eight explanatory variables are significant, at least at the ten percent level.

Of the variables representing household characteristics, family size is positive and significant, meaning that a greater number of household members increases the probability of being credit constrained. Family size as a proxy for risk-bearing capacity indicator confirms that the higher the number of household members, the more likely the households are to suffer from risk.

Table 7.17 Descriptive Statistics of Explanatory Variables

| Variable | Min | Max | Mean | Std Dev |
|---|---|---|---|---|
| Family size | 1 | 13 | 5.36 | 2.04 |
| Age of head of household | 20 | 83 | 43.75 | 14.17 |
| School attendance of head of households | 1 | 8 | 3.85 | 1.86 |
| Female head of household | 0 | 1 | 0.04 | 0.19 |
| Size of land owned | 0 | 11.38 | 1.90 | 1.93 |
| Total income | 56,250 | 80,800,000 | 6,441,727 | 8,192,799 |
| Share of land completed with land title | 0 | 100 | 34.11 | 44.11 |
| Distance to road | 0 | 13 | 0.90 | 2.67 |

Number of observations: 293

Human capital indicators such as the education (school attendance of head of households) have negative signs and are significant at the 10 percent level, implying that increasing either of those variables is likely to reduce the household's probability of being credit constrained. The more educated the head of the household is, the more responsible he is for making decisions for the whole family and tends to be better at calculating the future.

Table 7.18 Probit Estimation of Determinants of Household Formal Credit Constraints

| Variable | Coefficient | t value | Marginal effect |
|---|---|---|---|
| Constant | 3.556 | **2.73*** ** | |
| Family size | 0.113 | **2.08*** ** | 0.02 |
| Age of head of household (years) | -0.010 | -1.41 | -0.002 |
| School attendance of head of households | -0.102 | **-1.90*** | -0.22 |
| Female head of household | 0.001 | 0.07 | -0.003 |
| Size of land owned | - 0.001 | - 1.07 | -0.001 |
| Ln total Income | -0.151 | **-1.75*** | -0.033 |
| Share of land completed with land title | 0.001 | 0.35 | 0.0001 |
| Distance to road (hours) | 0.059 | 1.55 | 0.13 |
| Chi squared | | **16.96** ** | |
| Pseudo R squared | | 0.06 | |
| Log likelihood | | - 119.40 | |
| Observations | | 293 | |

Notes: Marginal effects in percentage points, calculated at sample means
*** and * are significant at 1 and 10 percent level respectively

Total income, as a proxy for welfare status, confirms that increasing the households total income reduces the probability of a household being credit constrained. This variable is significant at the 10 percent level. The implication is that a better household situation affects the decision of the lender to ration the loan or that the household has less demand for loans because of the households' own equity capital accumulated through past income earnings. The lender considers the welfare status of a client or potential client before signing a contract to provide the loan.

Variables related to the endowment of physical capital and those reflecting potential collateralizable assets are: the size of the land owned and the share of the land owned completed with a land title. These can be easily observed by formal credit institutions as a screening device before a contract is drawn up. The size of the land owned has a sign as was hypothesized; the larger the amount of land owned, the more likely that this will reduce the credit constraint. However, this variable is not significant.

It is expected that larger share of titled land will lead to a lower probability of credit rationing. The estimated coefficient of .001 is positive but fairly small in size and highly insignificant. Hence, a firm conclusion cannot be drawn regarding the role of land titling on credit rationing.

The distance from house to road as a proxy for market access, has a positive sign. This means that a longer travelling time increases the probability of the household being credit constrained due to the higher transaction costs and the locations of formal credit institutions are mostly close to the centre of economic activities with better accessibility. However, the result is weak significantly.

The marginal effects of each variable are provided in the last column of the table. Similar to other sections which apply a Probit model, the interpretation of marginal effects is as follows: for family size, for example, a marginal effect of 0.02 indicates that increasing the number of family members by one person leads on the average to a 0.02 percentage point higher probability of being credit constrained.

The overall analyses of determinants of household credit constraint verify that the key indicators are human capital and welfare status which are represented by education and total income, respectively. This can be seen from the t-values which are higher compared to other significant variables.

### 7.6.2 Impact of Households' Credit Constraints on Land Use Decisions

Results from the regression by using a sampled selection bias model for the pooled sample can be seen in Table 7.19. The total sample household for this analysis are 141 which use upland areas for cocoa and coffee. Some variables are significant in determining the decision of the household to cultivate cocoa and coffee in the upland area. The age of the head of the household has a negative impact and is significant at a 10 percent level. The total area cultivated has a positive sign and is significant at a 1 percent level of significance. This means that the larger the size of land cultivated, the larger the size of land devoted to cocoa and coffee.

Table 7.19 Results of 2SLS, Heckman Model on Land Use Decision for Perennial Crops (Cocoa and Coffee).

| | Coefficient | T value |
|---|---|---|
| Constant | 4.855 | **5.91***** |
| Age of head of household | -0.008 | **-1.74*** |
| Area cultivated | 0.004 | **8.55***** |
| Area paddy cultivated | -0.002 | -0.90 |
| Ln formal loan | -0.015 | -0.98 |
| Household ethnicity | 0.326 | **2.21**** |
| Number of adults | 0.030 | 0.70 |
| Ln total income | -.118 | **-1.93*** |
| IMR | 1.922 | **3.29***** |
| Adjusted R square | 0.47 | |
| F (8,132) | **16.77***** | |
| Observations | 141 | |

***, ** and * are significant at 1, 5, and 10 percent level respectively

The total income of the household has a negative effect on the upland areas which are devoted to cocoa and coffee. This means that the higher the income of the household, the smaller the areas in the upland cultivated with cocoa and coffee.

The use of formal credit can be seen from the variable of formal loan and seems to have a negative effect, but it is insignificant. However, there is an specification problem here. Among those household using credit, some of them may have been rationed and have obtained only a partial amount. In the case the household without any use of credit (zero loan size), some of them may have actually applied for a loan and have been rejected (as depicted in Figure 7.1). In order to obtain an appropriate result, an option is to split the sample into two groups: credit-constrained households and non-credit constrained households by using a switching regression model. The results from these regressions are presented in Table 7.21 and 7.22

Table 7.20 Land Use Decision by Non-credit Constrained Households

| | Coefficient | T value |
|---|---|---|
| Constant | 3.185 | 1.62 |
| Age of head of household | -0.005 | -0.41 |
| Area cultivated | 0.004 | **3.48***** |
| Household ethnicity | 0.595 | **1.80** * |
| Loan from formal credit markets | 0.028 | 1.36 |
| Size of paddy cultivated | -0.006 | **-1.96*** |
| Number of adults | 0.013 | 0.13 |
| Ln total income | 0.002 | 0.02 |
| Lamda | 0.333 | 0.33 |
| Adjusted R square | 0.35 | |
| F (8,19) | **2,91**** | |
| Observations | 29 | |

*** and * are significant at 1 and 10 percent level respectively

The sample households for non-credit constrained were 29 and 112 for credit-constrained households.

The coefficient for income has positive sign but is insignificant for the non-credit constrained households. In contrast, the coefficient for income has a negative sign and is significant at the 10 level percent. This result suggests that the credit-constrained households tend to reduce the area of land cultivated in the upland areas with cocoa and coffee along with increasing their income.

Similarly, the coefficient of loan size from the formal credit markets exhibits a different effect on each group. The non-credit constrained households tend to use their loans for increasing the areas which are devoted to cocoa and coffee; however this result is insignificant. The loans' coefficient has a negative sign and is significant at the 5 percent level for the credit constrained households. This finding confirms the fact that the additional loans from the formal credit markets are not used to finance their activities in the upland areas. Due to their welfare situation, the loans are used to fulfil other needs. The descriptive analysis shows that the credit constrained households are poorer compared to the non-credit constrained households

Table 7.21 Land Use Decisions by Credit Constrained Households

| | Coefficient | T value |
|---|---|---|
| Constant | 4.640 | **5.08***** |
| Age of head of household | -0.012 | **-2.15**** |
| Area cultivated | 0.004 | **7.49***** |
| Household ethnicity | 0.195 | 1.17 |
| Loan from formal credit markets | -0.039 | **-1.95*** |
| Size of paddy cultivated | 0.002 | 0.67 |
| Number of adults | 0.076 | 1.59 |
| Ln total income | -0.111 | **-1.64*** |
| Lamda | 2.611 | **3.79***** |
| Adjusted R square | 0.52 | |
| F (8,19) | **15.84***** | |
| Observations | 112 | |

***, ** and * are significant at 1, 5, and 10 percent level respectively

The coefficient of the age of the head of the household for both groups has a negative sign and is significant for the credit constrained but is insignificant for the non-credit constrained. This means that the older age of the head of household the smaller the size of the upland areas which are devoted to cocoa and coffee.

Interestingly, the coefficient of the size of paddy cultivated has a different effect respecting each group. This variable is used as a proxy for different agricultural activities. It is assumed that the larger the size in the lowland areas which are represented by the size of the area cultivated with paddy reduces the size of land cultivated in the upland areas. This coefficient for the non-credit constrained is negative and significant at the 10 percent level. This result suggests that respecting the non-.credit constrained households the larger the area cultivated in the lowland is, the more that reduces the size of the upland areas which are devoted to cocoa and coffee. In contrast, the coefficient for the credit constrained households is positive but is insignificant.

The coefficient of the ethnicity of the head of the household as a dummy variable has a positive sign for both groups but is different in the level of significance. In the case of the non-credit constrained households, this variable is significant at the 10 percent level. This means that the non-indigenous the head of household in this group tends to increase the upland areas which are devoted to cocoa and coffee.

# 8. Conclusions and Policy Implications

This study examined the issue of smallholder access to land and credit markets and its impact on the adoption of agricultural technology as well as land use, particularly in the upland areas which are devoted to cocoa and coffee. An improved understanding of the expansion of agricultural upland areas is crucial. At the current level of forest encroachment, the conversion of forest for the cultivation of upland could threaten the existence of the Lore Lindu National Park, leading to a loss of important ecosystem functions.

## 8.1 Dynamic Processes of Land Acquisition

The dynamic process of land acquisition by the rural households can be summarized as follows. In general, the households that live in villages located in the forest margins have relatively greater access to forestland. They begin land preparation for farming by clearing primary forest with the slash and burn method, which is followed by shifting cultivation. Each new generation requires more land for their farming activities, which leads to an expansion of this system over time. Because of some strict regulations by the local governments, the people experience difficulty when they try to clear the forest. In the case of the upland areas, the common mode of land acquisition is by clearing primary forest, especially respecting the local people and even more the young generations. In the

case of the lowland areas, most of the land is obtained through inheritance. Migrants often purchase land from local people. At same point in time, members of the indigenous communities started to sell land, often at prices far below its economic value. These changes in land tenure have led to an increasing scarcity of agricultural land for the indigenous population. Another complication is that the process of land transfer often occurs without proof of legal land transfer such as a land certificate. In terms of land security and the function of land as collateral, this evidence has a negative impact, particularly if the households wish to borrow money from the formal credit market.

This study found that only 20 percent of the plots that belong to rural households have an accompanying land certificate. Respecting these 20 percent, the form of the land certificate varies. The complexity of the land registration process as well as the lack of awareness of the households of the need to register land may be a burden to acquiring a land certificate.

The causal analyses of land acquisition showed that there is a close relationship between poverty and forest land acquisition. The negative sign and high significance level of the variable of poverty index as a proxy for the welfare situation explains that the wealthier households tend to acquire land from cleared primary forest less frequently than other groups. The accessibility indicator should be considered as one of the important aspects for the processes of deforestation. Households which live far from the main road indicated that they settled in the forest margin area to have better access to land from the forest for their agriculture activities. In highly developed areas, agricultural land is getting scarce, forcing some households to start new settlements far away from the main roads in the forest margin so as to have better access to acquire land from the forest for their agriculture activities.

Family land acquisition is influenced by various factors, including the ownership of forest land and household ethnicity where local/indigenous people tend to bequeath their lowland or rice land to their extended family. This means that they still maintain their values and that land is a source of self-insurance.

The process of land acquisition by purchase is related to the welfare status of the household and the household's ethnicity. The wealthier households and non-

local/migrant people accumulate land through purchase from other households while the poorer households use their family labor to clear the forest land. The findings on different modes of land acquisition show that when the traditional mode of land acquisition through clearing forest and inheritance become uncommon and when land becomes scarce, this activates a process of land acquisition through purchase.

### 8.2 Rural Financial Markets

In rural areas, there are typically two types of credit institutions: formal and informal. The two types differ in their characteristics, clients, and the financial services which they provide. The formal credit institutions are characterized by the following: (1) the loans provided are for long periods, on the average more than 1.5 years; (2) collateral is necessary before the contract is signed and the most important type of collateral is land secured by a legal certificate; (3) complexity of the procedure. On the average, the client needs 54 days to receive the loans after submitting all administrative papers.

The most important formal institution providing financial services is the Bank Rakyat Indonesia. This institution is located in every sub-district, and its strategy is to address the demand for savings and credit services in rural areas. However, this study found that even though in some villages agricultural activities promise positive returns, the BRI is not very attracted to finance this sector. Data from the three BRI village banks shows that the most important clients are from the permanent income groups (such as government employees) who then can use their loans either for consumption or production activities. The reason for this lending pattern is that BRI's agents perceive the permanent income groups as having a lower risk of loan default. Furthermore, the outreach of the formal credit institutions, mainly represented by rural banking (BRI), is biased towards wealthier households. Therefore, it is necessary to develop new lending mechanisms and technologies to promote access to the formal credit market for poorer households.

In contrast, the informal credit institutions are characterized by: (1) short term loans, on the average less than 2.5 months; (2) collateral is not required, but a specific contract is written so as to obligate the client to sell his product to the lender or buy some agriculture inputs from the lender (linkage with others markets such as agricultural input and output of products); (3) a simple procedure for contract arrangements where the client needs to

usually wait only 1 day after asking for the loan; (4) loans that are often demanded to address basic consumption needs.

The econometric analyses using a Probit model to determine the households' access to and participation in the informal credit markets show that some variables represent significant risk bearing indicators which suggests that the informal lender is an important agent for providing money to the poorest households. This can also be seen from the coefficient for food shortage which refers to a 12 month recall period reported by households which faced a lack of food (in days) and is positive and significant and indicates that households which face problems related to fulfilling their basic needs are more likely to borrow money from an informal lender.

## 8.3 The Impact of Household Access to Formal Credit Markets on the Adoption of Agricultural Technology

Apart from the econometric analyses of the informal credit markets, this study is concerned with the analysis of factors influencing household access to formal credit institutions. The results confirmed that on the supply side, the lender observes human capital (represented by the age and education of the head of the household) and value of the household assets as their major criteria for making the decision to lend to an applicant or not. Hence, human capital and wealth are important factors in determining access to the formal credit institutions. In the second step of the analysis, the amount of money borrowed (the demand side) was determined by income per-capita of the households, land title ownership, area of land cultivated, and the credit institution where the household became a client. Land title ownership has a positive impact on the amount of money borrowed. Hence, titling land provides an improved tenure security and at the same time improves one's access to formal credit. However, due to the expensive costs of getting a land title, there is a tendency that the wealthier farmers which control large plots gain benefits from the titling programmes. The area of cultivation as a proxy for the scale of agricultural activities has a positive impact in determining the amount of money borrowed. This means that financial support is still needed by farmers to enhance their agricultural activities.

One of the important aspects of this study is to provide econometric evidence on the impact of formal credit on the adoption of agricultural technology. The results show that the amount borrowed from formal credit institutions is a significant determinant of the amount of urea applied. Along with the predicted amount borrowed, other factors such as the age of the head of the households and the household's social capital positively influence the adoption of technology such as chemical fertilizer and pesticides. The descriptive statistic analysis shows that rice productivity significantly differs between adopters and non-adopters of agricultural technology. The farmers who do not apply such technologies are poorer than the adopters.

Social capital plays an important role in the adoption of agricultural technology. Through local institutions that exist in the rural areas, farmers can share information related to agricultural activities. It seems that the informal channels of information are more effective than the formal channels such as visits from the extension service. This situation could be explained by the fact that extension services cover more than one village and, therefore, often cannot visit farmers regularly.

The accessibility to the roads by rural households positively influences the adoption of technology. The farther the house of a household is from the road, the less urea they used and the less money they spent on pesticides. Obviously, these results are driven by higher transport costs, and lower output prices and higher input prices in more remote areas.

The results from the analyses of the determinants of the households' credit constraints show that human capital has a positive impact in reducing the probability that a household is credit constrained. Welfare status proxied by household income has a positive effect in reducing credit constraints. In contrast, larger families and, hence higher risks concerning shortfalls in the consumption of basic needs, increase the probability that a household's access to formal credit is constrained.

## 8.4 Impacts of the Households' Credit Constraints on Land Use Decisions

The econometric results show that credit-constrained and non-credit constrained households differ in their decisions concerning the cultivation of cocoa and coffee in the upland area. The coefficient of loan size from the formal credit markets exhibits a different effect respecting each group. The non-credit constrained households tend to use

their loans for increasing the area which is devoted to cocoa and coffee. In the case of credit-constrained households, however, the coefficient of loans has a negative sign and is significant at the level of 5 percent probability of error. This finding confirms that the additional loans from the formal credit markets are not directed to finance activities in the upland areas but to finance other activities, either consumption or other income–generating activities. It implies that an expansion of micro-loans to poorer, credit-constrained households may not have a negative effect on forest encroachment.

## 8.5 Policy Implications

The following policy implications can be derived from the results of the descriptive and econometric analyses.

Potential conflicts between inhabitants within and between villages as well as between villagers and the government are likely to increase in the coming years if the government is not careful in handling the issues related to land distributions and acquisition, particularly land ownership between local and non-local villagers. Moreover, in recent years the amount of land acquired through purchasing and clearing primary forest has increased tremendously. Therefore, strict regulations governing the limitation of land ownership and encroachment into the Lore Lindu National Park should be enforced.

The evidence of linkages between land and credit markets in the rural areas of Central Province make it clear that the function of land ownership by titling is not merely to increase land tenure security but also to be used as collateral. Therefore, the administrative process of registering land should be simple and connected with low costs in order to make it affordable for the people. Instead of the physical collateral requirements, social collateral or social capital could be exploited through the establishment of group-based or cooperative lending systems and the use of informal third-party guarantees so as to improve the access of the poor to formal credit. The Bank Rakyat Indonesia already has a special programme to offer loans to the poor without them needing to pledge any collateral. The maximum amount of this loan is 2 million Indonesian Rupiah. This programme, however, has not been implemented in the research area. The results confirm that there is a considerable demand by rural households for such a programme.

The existence of informal credit institutions is still needed, due to the nature of these institutions serving different types of credit demand such as consumption and emergency loans. Moreover, the clients of the two types of institutions differ. The government could utilize and cooperate with the informal credit institutions. These institutions could be seen as a new channel for delivering government credit programmes due to the close relationship between the informal credit markets and others markets (input and output markets for agricultural products).

Distinct government actions are needed to accelerate technology adoption in order to improve the agricultural productivity. If liquidity constraints are relaxed and access to information about agricultural technology is improved – also using informal local organization at the village level as a conduit for the dissemination of extension information - the poorer farmers will be able to obtain and adopt such technologies.

The results from the econometric models showed that the accessibility to the infrastructure and markets positively influences the adoption of technology. Therefore, the government could take actions to improve the rural infrastructure such as improving the road quality and constructing new roads which connect the farmers' houses with their fields. These improvements would reduce the farmers' and traders' transaction costs for the purchase of agricultural inputs, sale of outputs, and application of agricultural technology.

The improvement of the rural infrastructure has a positive impact on the households' access to formal credit. The results point out that the expansion of formal credit to the credit-constrained households will not deteriorate the environment, particularly in the upland areas. To the contrary, a negative effect is found when the loans are given to the (wealthier) non-credit constrained households because these households tend to expand their tree crop plantations and directly (or indirectly through the purchase of land from poorer indigenous households) contribute to forest encroachment. Hence, the negative impact of credit on deforestation needs to be mitigated by eliminating credit granted for the setting up of plantations within the Park borders, and the expansion of credit to the poorer segments of the population should be achieved in order to promote the adoption of agricultural technology on existing fields, support off-farm enterprises and alleviate consumption smoothing. Since there is a trade off tendency between credit expansion,

improvement of the infrastructure and the conservation of nature, the BRI-UD should clearly target the loans to reach the credit-constrained households (the non-rich households).

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# Appendices

Figure A. 1. Land Acquired in the Paddy Field (Lowland) through Inheritance from 1950 to 2001 Differentiated by Age Groups

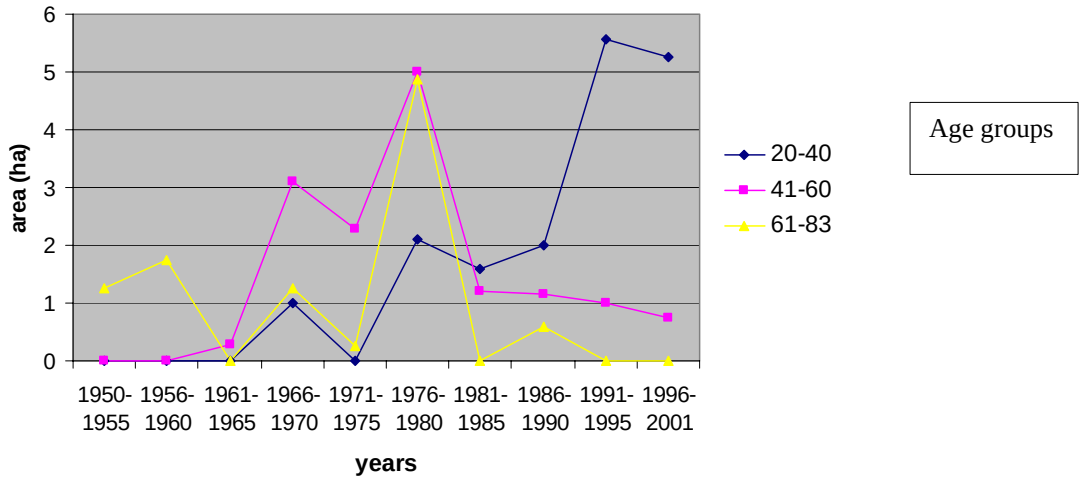


Figure A. 2 Land Acquired in the Paddy Field (Lowland) by Purchasing from 1950 to 2001 Differentiated by Age Groups

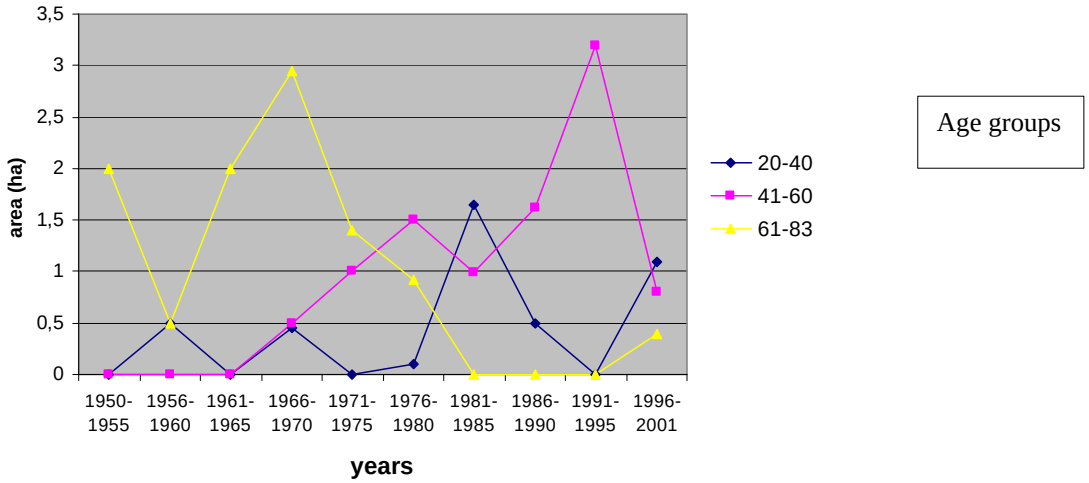


Figure A. 3 Land Acquired in the Paddy Field (Lowland) by Cleared Forest from 1951 to 2001 Differentiated by Age Groups

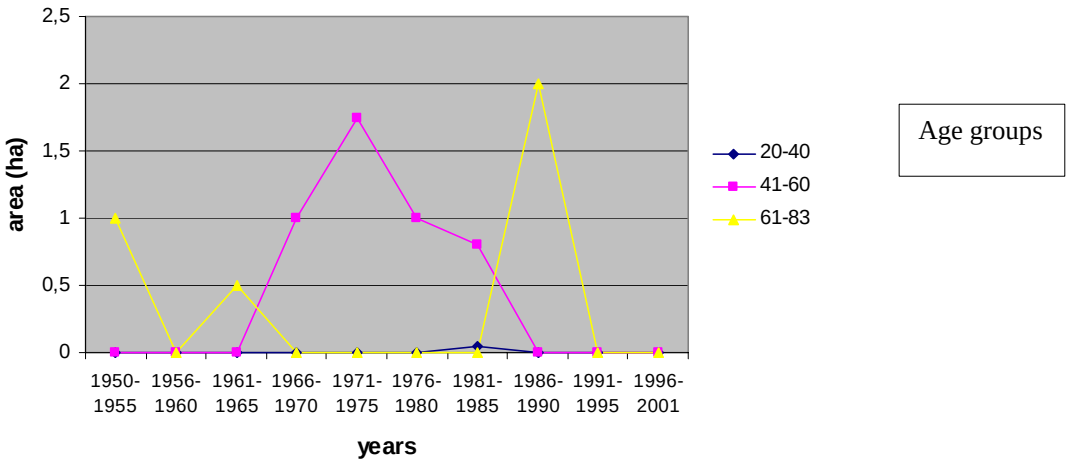


Figure. A. 4 Amount Loan and Delinquent Payment of the Government Credit Program (KUT) in District Donggala from 1995-2000

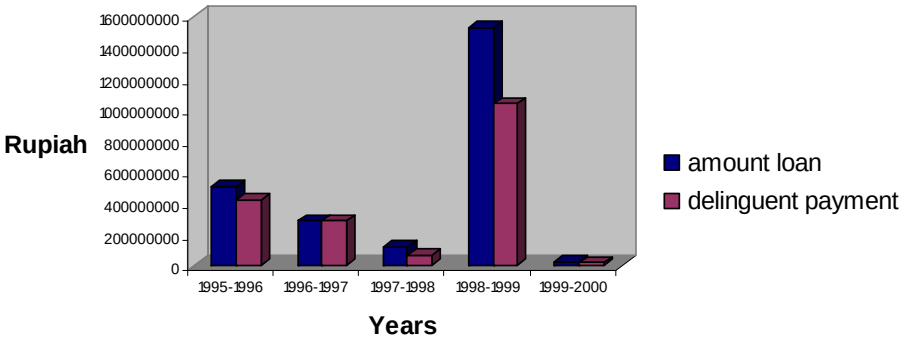

Table A. 1. T-test of Wetland Productivity between Farmers Apply Technology and did not Apply

| Variables | Do not apply(n=32) means | Apply technology(n = 84) Means | Sig level |
|---|---|---|---|
| Size of paddy cultivated (acre) | 51.65 | 69.75 | 0.039 |
| Rice yield (Kg per Ha) | 1007 | 1360 | 0.027 |